JPRS 76787

10 November 1980

Translation

MATERIAL ON JUNE 1980 ALL-UNION CONFERENCE ON DEVELOPMENT OF SIBERIA

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Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR-SERIYA OBSHCHESTVENNYKH NAUK in Russian No 6 [Issue 2], May 1980 signed to press 8 Apr 80 pp 10-152

[Translation of material presented at the June 1980 All-Union Conference on Development of Siberia, Izdatel'stvo "Nauka", Sibirskoye Otdeleniye, 2240 copies, 160 pages]

CONTENTS

Introduction 1

Regional Economic Programs

Survey of Experience in Using Programs To Solve National Economic Problems in Siberia
(B. P. Orlov, R. I. Shniper) 2

Organizational and Economic Problems in Managing the Process of Drafting and Carrying Out a Program
(R. I. Shniper) 15

Aspects of Expert Geographic Evaluation of the Data Support of Comprehensive Regional Programs
(K. P. Kosmachev) 32

Experience in Preplanning Studies of Siberia's TPK's

Directions in Improving Preplanning Preparation and Planning and Management of the Process of Forming Target-Program TPK's
(M. K. Bandman) 41

The TPK as a Subject of the Computerized System of Planning Computations
(M. Yu. Cherevikina) 73

Approach to Optimalization of the Spatial Structure of the Region's Economy
(M. K. Bandman) 82

[II - USSR]
[III - USSR - 3]

Problems in Studying TPK's in Regions With an Existing Production Structure
(R. M. Artyushkova) 95

Experience in Forecasting the Production and Spatial Structures of the System of TPK's of the Angara--Yenisey Region
(M. K. Bandman, et al.) 99

Boguchany Subregion of the Angara Valley in Krasnoyarskiy Kray
(V. P. Gukov) 125

Formation of the South Yakutia TPK
(L. I. Sevast'yanov, V. N. Churashev) 130

Aspects of Development of the Productive Forces and Preplanning Studies

Dynamic Pattern of Employment, Labor Productivity and Fixed Productive Capital in Siberia's Industrial Sector
(T. B. Baranova) 138

Problems of the Economic and Social Development of the South of West Siberia
(D. R. Bogorad) 149

The Kuzbass Regional Industrial Complex (TPK)
(A. I. Shrago) 161

Experience in Managing the Formation of the Bratsk--Ust'-Ilimsk TPK
(V. P. Gukov, F. L. Kagan) 170

Certain Problems in the Drafting and Performance of Comprehensive Regional Projects
(Yu. G. Benderskiy) 176

Analysis of the Impact of a TPK on Development of Adjacent Areas
(K. M. Losyakova) 182

Experience in Regional Analysis of the Angara--Yenisey Region
(A. Glazunov, et al.) 192

Experience in Using Mathematical-Economic Models in Determining the Economic Structure of a Region
(V. S. Zverev, R. V. Andreyeva) 197

Introduction

This issue of the journal is devoted to publication of papers prepared for the All-Union Conference on Development of Siberia's Productive Forces, which was held in June 1980 in Novosibirsk. These papers have been grouped under three headings. In the first, results are presented from research conducted in the Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences and devoted to the theoretical and methodological aspects of drafting regional economic programs and to summarization of the experience of carrying them out.

The second part describes the scientific spadework which has been done in the same institute during preplanning studies whose purpose was to develop methods of optimizing the sectoral structure and land use pattern of new regional production combinations, above all the regional industrial complexes being shaped in Siberia, and of applying these methods to specific cases.

The third division brings together articles devoted to particular aspects of the development and location of the productive forces of the region and to problems in preplanning studies. The papers were prepared by staff members of the same institute and by representatives of other scientific institutions.

The papers published here pertain mainly to the topics covered by the Section of Comprehensive Regional Programs and Siberia's TPK's [regional industrial complex].

REGIONAL ECONOMIC PROGRAMS*

SURVEY OF EXPERIENCE IN USING PROGRAMS TO SOLVE NATIONAL ECONOMIC PROBLEMS IN SIBERIA

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 11-19

[Paper by B. P. Orlov and R. I. Shniper, Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences, Novosibirsk]

[Text] The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" (July 1979) points up the need to draft programs of various types, including programs for development of particular regions (regionov), as an exceedingly important and integral part of multiannual plans for the country's economic and social development. The program organically links together the objective (objectives) of the steps to be taken with the economic, socioeconomic and other tasks which are regarded as a means of attaining the objective which has been set, and performance of these tasks is ensured by assignment of the necessary resources to the program. We look upon the regional economic program as the totality of measures ensuring comprehensive and balanced solution of a national economic problem in a particular area and within a given time. Ensuring comprehensiveness in development of the regional economy and proportionality in its sectoral structure (intersector balance) is one of the conditions for attainment of the necessary effectiveness of expenditures of social labor.[1] We are moreover referring to a problem (problems) whose solution has become an objective in order to serve nationwide interests, not local ones.

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* In addition to the papers published below, a number of previous publications in IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK have also been devoted to this problem: Yevseyenko, A. V., "Certain Problems in Shaping Regional Economic Programs" (Issue No 1, No 1, 1974); Yevseyenko, A. V., and Orlov, B. P., "On Retrospective Research Related to Structuring Regional Economic Programs" (Issue No 3, No 11, 1979); Marshalova, A. S., "Structure of Regional Comprehensive Programs" (Issue No 1, No 1, 1980); Untura, G. A., "On Scientific Substantiation of Comprehensive Regional Programs" (ibid.); Shniper, R. I., "Problems in Drafting and Classifying Regional Comprehensive Programs" (ibid.). We should also note two Rotaprinted publications of the Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences: "Voprosy programmno-tselevogo planirovaniya" [Problems of Target-Program Planning], Novosibirsk, 1975; Shniper, R. I., "Regional'nyye kompleksnyye programmy v sisteme narodnokhozyaystvennogo planirovaniya" [Regional Comprehensive Programs in the System of National Economic Planning], Novosibirsk, 1979.

A great deal of experience was acquired in Siberia even before the war in solving national economics with programs. And after the war major regional projects were carried out here using the target-program approach to planning to a greater or lesser extent.

We can identify certain common traits typical of the drafting and programmed accomplishment of all regional projects.

First, since each of them has been called upon to solve a major national economic problem (or problems), its accomplishment has been an important landmark in the country's economic and social development, and at the same time it has had an impact on an extensive area far exceeding the limits of the particular region defined as the area where the project was to be carried out.

Second, each of them has been accomplished by creating a series of regional-production combinations at various levels (industrial parks, regional industrial complexes), which has predetermined the stages and sequences of carrying out the particular project.

Third, performance of each project has required a large-scale regional redistribution of financial, physical and labor resources, since the project involved either pioneering development of a new area or a radical change of the economic structure of an inhabited area. We should note in particular that in both cases it was necessary to accomplish a sizable geographic transfer of labor resources, which reflects the manpower shortage that has come about historically in Siberia.

Fourth, because there has been little study of the area and because of the extreme nature of the natural environment, fulfillment of the projects necessitated thorough scientific preparation for development of new areas and the drafting of a technical policy that would take into account the unusual regional conditions of production. Moreover, the lack of our own technologies and highly productive pieces of equipment forced us as a rule to resort to foreign purchases of designs and manufacturing equipment, transportation equipment, and so on.

We will briefly describe the largest scale ("epochal") regional projects accomplished or now being carried out in Siberia.

The Urals--Kuznetsk Project, which came first, was drafted in the dawn of the USSR's forced industrialization. Its objective arose out of nationwide ("national") objectives, which simultaneously took into account economic interests, the interests of social welfare policy and the interests of military strategy and which took the form of building in the Urals and Western Siberia the industrial base necessary to industrialization of the country's eastern zone. Attainment of this goal was in line with the state's orientation toward optimum geographic location of the productive forces in the country and with its course toward an economic uplifting of backward regions and toward social transformations in this macroregion.

The Urals--Kuznetsk Project is rightly regarded as a logical and meaningful basis for the drafting of specific measures which in their totality actually constituted an integrated set of steps, including planning and managerial procedures, which affords the basis for regarding the accomplishment of this project as a model of the target-program approach in the context of prewar development.

The various sections of this program were organically connected with one another and were aimed at laying the foundation for ways of attaining the objective set forth in the conception of the Urals--Kuznetsk problem, which was interregional: it envisaged joint utilization of the mineral resources of adjacent areas in order to furnish raw materials to the USSR's second coal and metallurgical complex. Its functioning on the basis of a pendulum exchange of the iron ore of the Urals for the coking coal of the Kuzbass made it possible to look upon the regional-industrial combination created precisely as a Urals--Kuznetsk combine (this concept was to lose currency, since independent regional industrial combinations were formed in the Urals and in the Kuzbass). In this project the country's second coal and metallurgical complex was oriented not only to meeting the needs of the entire union: it also figured as the basic nucleus for formation of a multisector production complex. The need to interlock sectors and industries and combine production operations on the basis of multipurpose utilization of the natural resources of Siberia and the Urals was accordingly foreseen. Plans called for exploring the sources of minerals and raw materials of this combine, the potential for the timber and lumber industry, fuel and power resources and water resources and for determining their value to the national economy.[2]

The problems of a technical policy occupied an important place in the program, and prospects for creating new technology and for its use in the region's industrialization were examined. The lack of previous design work on which to draw and the underdeveloped state of the domestic machinebuilding industry made it necessary to use foreign technology and equipment extensively. To be specific, the Kuznetsk Metallurgical Combine was built in that way. Generally speaking this method of technical progress was extensively used in the First Five-Year Plan in the USSR, since the transfer of foreign technology (to use the terms of Professor V. S. Muchnik), was practically the only possible method in that period.

Much attention was paid in the program for solving this problem to demographic problems as well, to forming a balance of labor resources and to the training of personnel. A large migrational influx of population was caused by the program's implementation. Between 1926 and 1939 more than 3 million persons moved to the Urals, to Siberia and also to the Far East from the European part of the country.[3]

The problems of organizing scientific research and project planning were given independent sections of the program, and an important place was allotted to the problems of the economic efficiency of carrying out all the measures intended and to analyzing the impact of this program on development of other parts of the country.

This program was carried out during the thirties and early forties and turned out to be the largest in terms of costs and the most effective from the standpoint of long-range consequences of the action of the state through its measures toward regional organization of the productive forces. The shaping of regional-production combinations--the Kuzbass TPK and the Novosibirsk and Omsk industrial concentrations (uzly).

A notable feature of the drafting and implementation of the Urals--Kuznetsk Project was that the program approach was taken to management. The Urals--Kuznetsk Commission of USSR Gosplan was set up to work out the scientific foundations and for subsequent coordination of the actions of various organizations involved in carrying out the program. Later a specific entity--a bureau of the USSR Council of People's Commissars headed by V. V. Kuybyshev--was organized for the day-to-day supervision and coordination of actions of different organizations in solving the economic and other tasks.

Thus, the Urals--Kuznetsk Program, taking certain restrictions of the prewar period into account (the acute shortage of financial and physical resources, hindering attainment of the intended proportionality and development of the various economic sectors; the paucity of work that had been done on methodological and procedural problems of planning and management; and the lack of experience in carrying out large-scale national economic projects), can be regarded as a bold experiment with the target-program approach to solving a large-scale interregional problem and, moreover, one that was carried out with quite a bit of success.

The Angara--Yenisey Project comes in second place after the Urals--Kuznetsk not only in chronological terms, but also with respect to the logic of implementing the course toward successive eastward movement of the country's productive forces. Creation of an industrial concentration in Western Siberia provided the springboard for subsequent development of the productive forces of Eastern Siberia by solving the Angara--Yenisey problem. The concentration of enormous reserves of hydropower potential in this region along with favorable conditions for exploitation and the high concentration of reserves of other natural materials--it was these prerequisites which defined the objective of the project (and the program)--and the transformation of that region into the country's most important center for production of cheap electric power and products of energy-intensive production operations.

All the efforts undertaken under the Angara--Yenisey Project were integrated and distinguished by a broad analysis of its transformational role in Siberia's economic and social life. The prewar years went to prepare the scientific foundations of the project. In the peacetime practice of the twenties and thirties there was no precedent for the construction of hydraulic engineering structures of such technical and economic complexity. The question of the economic efficiency of using the electric power was very important. The drafters of the project adopted the orientation toward development of energy-intensive production operations. A second problem was related to selection of the most progressive form of spatial organization of production. N. N. Kolosovskiy advanced the idea of creating regional production combinations, which later came to be called regional industrial complexes and industrial parks. This idea turned out to be economically feasible even for other regional problems which were solved or which are being solved in the eastern regions of the RSFSR and also in other regions. Tremendous financial, labor and physical resources were necessary to carry out the Angara--Yenisey Project. That is why a series of stages was established for its realization.

The first stage consisted of the research work: these were the preplanning and preproject stage of work on the Angara--Yenisey problem, which was assigned to the Angara Bureau of Gidroelektrostroy [expansion unknown]. The comprehensive approach was fundamental to this research: the hydroelectric power stations, water management and energy consumers were taken in their entirety as components of the overall power and industrial complex.

This resulted in the drafting of the first variant of the Angara--Yenisey Project (1935), which after the war was supplemented by a number of considerations suggested by the results of new research, by the progress of science and technology, and by a change in the national economy's demand for the products of the region.

It is important to note in this connection how important it is that an interval of nearly 12 years passed from the drafting of the project to the beginning of its realization (in the first half of the fifties). In that time science had been able not only to obtain additional data on the region's potential and on technical and technological possibilities for utilizing it effectively, but also to issue "hints" to the design and drafting service (and through it to production) concerning desirable technologies for developing and processing natural materials, concerning the technical-and-economic parameters of equipment, and concerning the organizational forms of production. This resulted in a revised structure of the economy, unit capacities of hydroelectric power stations and their respective units were enlarged over the previous intentions, and orders were placed in good time for custom-made equipment.

The second stage was formation of the Irkutsk--Cheremkhovo TPK, which specifically involved construction of the Irkutskaya GES; and the third stage was the formation of the Bratsk--Ilimsk TPK (including construction of the hydroelectric power stations bearing that name). The fourth stage can be associated with creation of the Central--Krasnoyarsk and Sayan TPK's and the respective GES's, and the fifth commencement of creation of the Lower Angara TPK (whose power nucleus is the Boguchanskaya GES) and possible formation of the Upper Lena TPK in the western part of the zone for economic development of the BAM [Baykal-Amur Main Rail Line].

Under the conditions of the present time we can already raise the issue of drafting a long-range program for completion of solution of the Angara--Yenisey problem, which specifically presupposes supplementing it with the task of setting up the KATEK [Kansk--Achinsk Fuel and Power Complex]. With this addition the problem would take on a new direction--creation of a fuel and power concentration for location of energy-intensive production operations using another source of raw materials (brown coal), which previously was not foreseen. It is possible that the objective of forming the KATEK would also reflect the need for large-scale transfer of sources of energy to other regions of the country.

Creation of the Western Siberian Petroleum and Gas Complex. The problem of forming this complex proved to be the most complicated of all such initiatives on the part of the state. It is unusual in the objective ("external") conditions for economic development of the area (size of reserves, extreme nature of the natural environment, the region's distance from industrial centers, the absence of an infrastructure and the like) and the rate of attainment of the goals which were set. It involved an unprecedented amount of outlays: in the last 10 years they exceeded the sum total of capital investments to build the VAZ [Volga Motor Vehicle Plant], the KAMAZ [Kama Motor Vehicle Plant], the BAM, and Atommash [Soviet enterprise specializing in manufacture of nuclear power plant equipment]. At the same time, as progress has been made in solving this problem the country's national economy has already received a considerably greater gain than from the creation of those facilities. The capital investments are paying off faster than in the country's other regions.[4]

The first stage of shaping this complex is creation of the USSR's major petroleum concentration (this was achieved in the mid-seventies) and creation of the basic foundation for production of natural gas (end of the seventies). The second stage, which followed at the end of the last decade,[5] is characterized by transformation of this complex into a multisector complex and by new relationships in the development of these two concentrations, which comprise its "load-bearing skeleton."

Far-reaching goals were not set in the first measures toward economic development of the northern portion of the West Siberian Plain, since a modest assessment was put on the commercial reserves of natural materials that would be exploited. A decree of the USSR Council of Ministers in May 1962 called for organization of the production of petroleum and natural gas in Western Siberia by 1966 and for bringing this production up to 5 million tons and 10 billion cubic meters, respectively, by 1970.[6] In April 1956 USSR Gosplan already had called for production of 19 million tons of petroleum in 1970.[7] But the growth of commercial reserves of petroleum made possible a drastic change in the assessment of the region's potential, and in late 1969 a special decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Measures Toward Faster Development of the Petroleum Industry in Western Siberia,"[8] policymaking bodies proclaimed it to be an exceedingly important task of the national economy to build a large new national petroleum production concentration in Western Siberia in the years immediately following and to guarantee the petroleum production in that region would reach 100-120 million tons in 1975 and 230-260 million tons in 1980. The decree enumerated specific tasks of organizations called upon to develop the petroleum deposits.

Consequently, this decree can be examined from the standpoint of the target-program approach: it formulated an objective of the national economy which was to be realized in a region (Middle Ob' Valley), and it pointed out the basic economic and other tasks which were to be regarded as the means of attaining that goal. The latter--in the light of subsequent evolution--can be interpreted as creation in the Middle Ob' Valley of the country's major source of petroleum with long-term significance: even in 1974 this field had passed Tataria, which was previously the principal source of petroleum; the production targets indicated above for 1975 and 1980 were substantially exceeded, and in the last year of the 10th Five-Year Plan the volume of petroleum production here exceeded more than threefold the level of Tataria and amounted to more than half of national production.

The country's new source of petroleum was built up in the Middle Ob' Valley in an unprecedentedly short time--in just a decade, and the decisive role in this was played by formation of the Nizhnevartovsk industrial park, which in 1975 had a share of two-thirds of all the petroleum produced in the West Siberian Plain.

The problem of building this source of petroleum was solved under complicated objective conditions resulting because the natural environment is extreme and had not been previously studied, because the economy had not been developed and because the region was sparsely inhabited. The need for economic development of the new area in and of itself made it impossible to avoid large pioneering outlays for infrastructure (for transportation, for other productive purposes and also for social amenities and utilities. The "northern" factor in higher construction costs at least doubled one-time expenditures. At the same time, however, there was a shortage of financial resources and construction capacities. We were not for that reason successful in achieving balanced development either, first, between the petroleum industry and related sectors of the economy (especially transportation and construction), or, second, between production and the infrastructure for social services and utilities. In other words, the capabilities of the program approach, which result from consistently taking balance-connections and resources into account, were not taken advantage of.[9] Moreover, we were not successful in overcoming duplication and parallelism in expenditure of capital to build infrastructural projects for production, much less nonproductive activities, which increased capital outlays and current costs as compared to their centralized (extradepartmental) use.

By contrast with the Urals--Kuznetsk and Angara--Yenisey problems, whose practical solution was preceded by many years of research and an accumulated backlog of project planning and designing, the problem of building the country's principal source of petroleum in the Middle Ob' Valley began to be solved while the discoveries of the geologists were "still warm," when there had been little scientific and engineering-and-technological preparation for economic development of an unusual area, i.e., once again with a definite departure from the requirements of target-program planning. For the first time in world economic history a facility of this kind was built, first, "in a morass," and second, in the North. At the same time the scientific knowledge of the region that was to undergo economic development was sketchy, and the technologies and implements to be used proved not very suitable (this was also characteristic of the first period of developing the gas resources of the Arctic).

In actuality scientific research, planning and economic organizations had no extra time in which to draft an all-inclusive and balanced regional program containing not only an elaborate definition of the goals of economic activity and the tasks that would ensure their attainment, but also an exhaustive list of the necessary resources in interrelated measures (beginning with research and project planning and design work), and also outlining strict time frames for each stage of the program's accomplishment.[10]

The problem of shaping the new source of natural gas in the West Siberian Plain originally had a subordinate status relative to the petroleum problem, which was manifested in the differing amounts of financing, but from the beginning of the seventies a more vigorous effort began: reorientation from exploitation of the Berezovo field, where the reserves were small, to developing the deposits of the Arctic zone. Consequently, within the West Siberian Petroleum Complex there took place a ranking of capital investments, which were concentrated in time and by projects (much the same has also been typical of its subsequent development).

The orientation toward development of these deposits reflected adoption of a new objective--creation of the country's principal source of natural gas in Western Siberia. This objective was expressed in the assignments of the 10th Five-Year Plan: capital investments in the region's gas industry were stepped up sharply and provision was made for a sharp increase in production of natural gas (3-4-fold over the 5-year period). Whereas in 1975 this production (converted to petroleum) was only one-fourth of petroleum production, in 1980 it had already reached nearly one-half.

A large lag of the infrastructure behind development of the principal production operation was allowed in the process of creating this facility, and that also resulted in overexpenditure of funds.

Experience in solving these two problems vividly demonstrated that underestimation of the advantages of the target-program approach in planning and management practice when major capital investment projects are being carried out tends to increase the time required to perform the various tasks and to substantially increase the costs to the national economy.

We would also like to note shortcomings in coordination of the efforts of the partner organizations involved in solving these problems. It was made difficult by substantial differences in the rates of financing of the interacting organizations, by the poorly coordinated planning of their operations, by discrepancies in criteria used to assess their activity, and by other circumstances.[11]

Consequently, if we speak in the most general terms, then higher efficiency of expenditures of the national economy can be achieved by attaining intersector balance, through optimum distribution of capital investments and by utilizing other capabilities of this approach.

Program for Economic Development of the BAM Zone. One of the most important nationwide problems which will be solved in the eighties is economic development of the BAM Zone. Its construction has a long prehistory: the task of building this main rail line was set back before World War II, and a beginning was even made to solve it. Conceptions of the purposes of this effort have, however, changed substantially since that time. Originally it was its purely transportation importance that was in question, while in the seventies construction of the main rail line has been given a broad intersector interpretation.[12]

Today researchers are unanimous that the construction of the BAM will in time make it possible to shape a new industrial belt in the Near North of Eastern Siberia and the Far East, which will interact with the first belt, built along the great Siberian main rail line.

Intensive economic development of the Near North will undoubtedly have far-reaching consequences, which predetermine the entire course of development of the country's eastern zone. Following adoption of the decree on construction of the BAM by the country's policymaking bodies, then, it was deemed advisable to conduct further research on the basis of a single comprehensive coordination plan.

In order to coordinate the efforts of numerous scientific and project planning organizations it is extremely important to define the ultimate objective (objectives) and to formulate the conception that will be the point of departure in outlining specific tasks for each creative collectivity.

The comprehensive nature of the actions to be taken and the great diversity of their consequences were taken as points of departure in defining the objectives of building the main rail line and of economic development of its zone. First of all, construction of a latitudinal main rail line extending more than 3,100 km and providing a second access to the ports of the Pacific Ocean basin, and of the meridional main rail line from the BAM to Berkakit via Tynda would bring a huge territory extending over 1.5-1.6 million square kilometers into economic circulation. Tremendous natural resources are concentrated in this area, above all mineral raw materials and timber which cannot be used on any large scale until transportation is developed in these areas. Second, the BAM is a backbone main line from which other transportation routes will eventually begin to thrust into areas of industrial development. At the same time it is becoming a part of what in future will be the second transsiberian railroad, which will run through the Near North. Third, economic development of the BAM Zone will create favorable prerequisites for shaping the country's unified power system on the basis of unification of the Far Eastern and Southern Yakut power systems with the unified power system of Siberia. Fourth, economic development of the BAM Zone is necessary to performance of the very important national economic task of settling the country's eastern regions. Fifth, the Baykal-Amur Main Rail Line will have great foreign economic importance, above all for strengthening the Soviet Union's connections with the countries of the Pacific Ocean basin.

When the scheme for the comprehensive research program was being structured, it was necessary to take into account both the tasks of preparing and carrying out major sectoral and intersectoral projects in the BAM Zone and use of the most effective forms of regional organization of production, as well as the unusual complexity of the natural environment, which imposes specific requirements on technology and engineering, on standard allowances for construction of social, residential and cultural service facilities, and also on ecological measures.

Research on the problems of the BAM is being conducted simultaneously with construction of the main rail line. This puts a definite imprint on the organization of efforts; in particular, the project planners and builders of the BAM are involved in the extensive discussion of the results of the various stages of research, which make this research more purposive and makes it possible to respond quickly to requests from practitioners. This has become possible because from the very beginning of setting up the research projects the Scientific Council of the USSR Academy of Sciences for the Problem of the BAM was set up; it has now become the coordinating and guiding center.

Summarization of the experience acquired makes it possible to draw certain conclusions concerning the technology for solving the problems that arise between study of a problem and the drafting and performance of a program. We can identify four stages in that interval. They are, first, the scientific and preplanning work on the basic aspects of the problem. Practical accomplishment of any large-scale regional problem is possible only if scientific knowledge and the physical and technical prerequisites have previously been built up for staging the subsequent operations on a broad scale. Second, project planning and surveying work and settlement of intersector and sectoral problems of architectural layout and production technology. In this stage it is most important to select the pivotal industries or intersector complexes so as to take into account stocks of relevant natural materials and possibilities for financing their development. The scale of development of industries and complexes is determined as a function of their role in the shaping of all-union balances of production and consumption of products so as to take into account alternatives of their production and export-import connections. Third, performance of the investment subprogram. In this stage it is important to examine different situations that have an impact on conditions for shaping TPK's, their makeup, the scale of production operations and the pace of construction. If there is a shortage of resources, it is obviously important to select a sequence of construction which will yield the fastest return and make it possible to perform intermediate tasks leading toward the ultimate objectives of the program. Fourth, bringing production capacities up to designed output and achieving efficient functioning of the TPK's and industrial parks that are built. In this stage we encounter indeterminacy in the domain of interchangeability of resources under the impact of scientific-technical progress. This necessitates a thorough study of trends in their consumption under the impact of the development of science and technology and evaluation of their possible impact on the structure of physical balances and intersector relations.

Strict observance of chronological sequence in going through these stages cannot be required: in practice they are often coincident in time. Dates for their performance depend to a considerable degree on the character and scale of the regional problem. But one thing is clear: these stages are not taken up in the conventional planning intervals.

Research on the problem of the BAM has shown that the level of scientific and project planning preparation of the various projects making up the program is uneven, and this predetermines the time sequence for performance of particular tasks. Carrying out the program for economic development of the BAM Zone obviously requires several decades, which naturally will make it necessary to build up spadework for setting up the subsequent stages running even into the 21st century.

FOOTNOTES

1. Economic programs do not guarantee high efficiency of performance of capital investment projects if they are set up without sufficient consideration to balance connections and resources. (Krasovskiy, V., "Efficiency of Targeted Economic Programs," VOPROSY EKONOMIKI, No 12, 1976, p 46)

2. The program of summary work on the Urals-Kuznetsk problem has been described by N. N. Kolosovskiy (PLANOVOYE KHOZYAYSTVO, No 12, 1930).

3. Popov, Z. E., "Problemy ekonomiki Sibiri" [Problems of Siberia's Economy], Moscow, Ekononika, 1968, p 44.

4. EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVO, No 3, 1979, p 8.

5. In the literature it has come to be called the "new stage." Its characteristic features are given, to be specific, in the article: Orlov, B. P., "The Middle Ob' TPK: A New Stage of Development," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 1), No 1, 1980, pp 33-35.

6. Central State Archives of the USSR National Economy, repository 233, inventory 1, item 29, sheet 4.

7. Ibid., inventory 3, item 274, sheet 46. In actuality, 31 million tons of petroleum and nearly 10 billion cubic meters of gas were produced in 1970.

8. "Resheniya partii i pravitel'stva po khozyaystvennym voprosam" [Decisions of the Party and Government on Economic Questions], Vol 7, July 1968-1969, Moscow, Politizdat, 1970, pp 579-582.

9. The consequences of this have been covered, specifically, in the articles of V. M. Pushkarev and V. N. Kharitonova. See Pushkarev, V. M., "Certain Problems in Shaping the Nizhnevartovsk Industrial Park," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 1), No 1, 1976, pp 57-61; Kharitonova, V. N., "Comparative Efficiency of Alternatives for Development of the Nizhnevartovsk Industrial Park," ibid., (Issue No 2), No 6, 1978, pp 61-69.

10. These requirements for the program as a "planning document" have been set forth, to be specific, by A. G. Aganbegyan. See Aganbegyan, A. G., "Upravleniye sotsialisticheskim predpriyatiyami. Voprosy teorii i praktiki" [Management of Socialist Enterprises. Problems in Theory and Practice], Moscow, Ekonomika, 1979, pp 126-127.

11. Yevseyenko, A. V., and Orlov, B. P., "On Interaction of Organizations in New Areas Being Developed," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 2), No 6, 1975, pp 39-46; and by the same authors, "On Retrospective Research on the Structure of Regional Economic Programs," ibid., (Issue No 3), No 11, 1979, pp 56-60.

12. Shniper, R. I., "Regional'nyye predplanovyye issledovaniya" [Regional Preplanning Research], Novosibirsk, Nauka, 1978, p 124.

ORGANIZATIONAL AND ECONOMIC PROBLEMS IN MANAGING THE PROCESS OF DRAFTING AND CARRYING OUT A PROGRAM

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No [illegible] May 80 pp 20-31

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[Text] Whereas sectoral and regional planning are firmly assigned to a smoothly operating system of management entities, which ensures achievement of the indicators of the plan by using the economic mechanism that exists for accomplishing the necessary maneuvers with resources and production capabilities, the comprehensive regional program does not have this. The one-time solutions which are widely used in various programs define only their objectives, the list of those responsible for performance and the resources, but they are unable to ensure their inclusion in the everyday rhythm of the economic and social development of the sector or industry, the area or the country as a whole.

From the organizational standpoint there are several alternatives possible for linking regional programs to approved plans. The most accessible variant, one which does not require any sort of restructuring, is when it is sufficient to draft the program and schedule its tasks for the entities interested in its performance that already exist. In this case one must rely on the self-discipline of ministries and departments. The slightest shift related to organizing efforts on the initiative of one of the departments can disrupt the time sequence and synchronization of the program's progress and thereby reduce its effectiveness and reliability.

It is more acceptable to organize a temporary entity in the framework of USSR Gosplan to perform largely coordinating functions. It would be up to this entity to schedule the assignments of the program in the 5-year and current plans of ministries and administrative subdivisions, to check their fulfillment and, if necessary, to put pressure on the participants when there is a deviation from the program's network schedule.

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* The recommendations made by the author of the article pertain primarily to drafting and carrying out the program for economic development of the BAM Zone.

The ideal alternative is when organizations bearing full responsibility for the scientific work, the project planning and performance of construction work are created to draft and carry out the programs. In addition to active performance of coordinating functions, these organizations, which have definite resources, resolve all questions related to development of the construction and building materials industry and to the infrastructure of production and social amenities and utilities. It is an indispensable condition that the program be included in the USSR national economic plan with a breakdown of the assignments by individual ministries and departments. In this case construction of industrial enterprises and large installations is done by the respective sectors and industries, and at the same time the scientific-technical, socioeconomic and ecological requirements of the program are strictly adhered to.

The mechanism adopted at present for management of the economy is unable to accomplish a radical reorientation of the intentions of ministries and departments in regional investment policy when the need arises. At the same time integrated performance of capital investments and socioeconomic tasks should depart from the generally accepted principles of distribution of the resources of the national economy depending on the regional conditions for carrying out the intended program. Such departures are justified: we are referring to performance of large-scale tasks that result in creation of new regional proportions and alteration of the sectoral structure of entire regional systems. In the practice of building socialism the state has more than once granted a privileged status to various sectors of the economy, bringing into play instruments that make it possible to stimulate their priority development. This is all the more necessary in drafting and carrying out comprehensive regional programs. These programs should be documents that possess active attributes; every program drafted should be examined and approved by the relevant policymaking bodies, and the principal stages for carrying out the program should be identified. It is extremely important in this connection not only to establish the entire set of measures contained in it, but also to identify those of them which it is best to do first in order to ensure synchronization of activation of the first projects and creation of various stages of spadework for accomplishment of the other phases.

It is a peculiarity of the program approach that the entire set of measures necessary to attainment of the ultimate goals of the program is examined, and resources are provided on the basis of a specific definition of its physical structure in various stages. Nor is it precluded that the physical backing of the program could make it necessary to create new production operations or to make timely decisions to import products.

Under the influence of technical progress various engineering and technical solutions embodied in the program tend to become obsolete as a rule. In the process of carrying out the program, organizations responsible for its fulfillment should be responsive to changing conditions and make the relevant adjustments. This is realistic only when an operable system is set up to manage the processes of drafting and carrying out the program.

Both the drafting and approval of programs and also their realization require their own organizational forms of management.

Algorithm for Drafting the Program. The principal client (USSR Gosplan) defines the initial assignment, which sets forth the general objectives of the program and the system of interrelated measures (in consolidated form) aimed at attaining them, and also the list of normative-legal acts regulating socioeconomic policy, procedural principles for backing the program with resources, and the system of economic and social indicators.

The initial assignment is passed on to the organization responsible fo drafting the program. It should be authoritative in solving related questions that arise and should possess the financial and other resources adequate to drafting it. Such an organization for the program of economic development of the BAM Zone might be the RSFSR Council of Ministers, and its powers would include approval of the principal drafting organization; setting the date for the beginning and end of drafting; approval of the estimated costs of drafting the program; financial and physical support of the program's drafting; rendering of assistance to the leading organization for drafting the program in enlisting interested ministries and departments, project planning and scientific research institutes of sectors and industries, and also local soviets of people's deputies of krays and oblasts in the area where the program is to be carried out; discussion of the completed version of the program and its submittal to USSR Gosplan for examination.

The Siberian Department of the USSR Academy of Sciences might become the principal drafting organization for the BAM program. Its principal tasks would be as follows:

i. analysis of scientific knowledge and assessment of the information base;

ii. revision and specific designation of participants;

iii. drafting of assignments for interested ministries and departments and discovery of their interests in this problem, as well as setting the qualitative and quantitative indicators for sectoral and intersector projects in which these ministries take part;

iv. compiling the network schedule for drafting, correlating and approving the program;

v. work on general problems of methodology and method and their discussion with the participants;

vi. clearance with the respective ministries of stages in which the particular industry or sector would be involved and also of start-to-finish synthetic quantitative and qualitative characteristics of the program;

vii. drafting variants of the program reflecting the particular conceptual approaches and resource limitations, cleared with USSR Gosplan and interested ministries and departments, and selection of the optimum alternative in the first stage;

viii. holding of conferences to discuss particular aspects and the program as a whole.

The program is submitted for examination to the organization responsible for drafting it and to the client, then the relevant changes are made, and the final version of the program is submitted for approval. After approving the program USSR Gosplan submits it for approval to policymaking bodies and includes the first and second phases in the main lines of socioeconomic development of the country and of sectors and industries and regions. The first phase is included in all cross sections of the next 5-year plan in order to achieve balance with respect to all resources.

Structure and Functions of Entities for Management of Realization of the Program. An effective system of management bodies furnishing horizontal and vertical relations should be created to organize management of the process of carrying out the program. The guiding unit of this system is a commission of the USSR Council of Ministers headed by a deputy chairman, whose competency includes the following:

i. ensuring that individual projects are built and put into operation in the proper order for inclusion in multiannual and current plans;

ii. examination of technical-and-economic and technological solutions determining labor-saving policy and related to the manufacture of new technology;

iii. settlement of intersector questions related to construction of the zonewide infrastructure of industry and of social amenities and utilities;

iv. appointment of responsible supervisors to carry out the program;

v. revision and adjustment of different versions for carrying out the program as a function of progress in its fulfillment;

vi. ensuring that physical, material and technical and labor resources are in balance;

vii. organization of expert evaluation of the program's most complex intersector projects;

viii. examination and approval of summary itemized lists for shaping individual TPK's;

ix. examination and submittal for government approval of normative and legal acts regulating behavior of participants and ensuring encouragement of the process of carrying it out;

x. appointment of the program's managing director.

The members of the Commission for the BAM Program included a responsible representative of the leading organization, the program's managing director, who is at the same time the deputy chairman of the commission; representatives of the main project planning institute and the general contractor, and a representative of the RSFSR Council of Ministers.

Subdivisions for the program of economic development of the BAM Zone are being set up under USSR Gosplan and RSFSR Gosplan to dovetail the program with multiannual and current plans being drafted. Their tasks are as follows:

i. clearance of the recommendations of the program's management for inclusion of quantitative and qualitative indicators of the program in the respective 5-year and annual plans and seeing that the program is furnished financial and physical resources;

ii. clearing draft versions of the plan for the program with respective divisions of USSR Gosplan and RSFSR Gosplan;

iii. drafting and submittal for consent of the program's management changes in the indicators of the 5-year plan on the basis of progress in carrying out the program;

iv. organization of the drafting of economic and social standards to be used in drafting stable 5-year plans for carrying out the program;

v. exercise of supervision over fulfillment of the obligations of ministries and departments as well as regional Soviet bodies as the program is carried out.

Direct supervision over realization of the program is exercised by the program's management, which is headed by a deputy chairman of the Commission for the BAM Program. It performs the following functions:

i. prepares the draft of the multiannual and current plans within the framework of the approved program for submittal to the commission of the USSR Council of Ministers and USSR Gosplan;

ii. it clears these plans with the respective ministries and departments;

iii. it determines the order of sequence for formation of regional industrial complexes and planning assignments for inclusion in multiannual and current plans;

iv. it appoints supervisors of the management for the programs of shaping the TPK's;

v. its clearance is required for feasibility studies and project planning assignments submitted by interested ministries and departments;

vi. it defines requirements for participation of ministries and departments in shaping the zonewide infrastructure of production, in solving social problems and in performing measures related to multiple use of resources and environmental protection;

vii. it is the entity dispersing physical and financial resources for development of intersector production operations and infrastructural sectors and for solving the social problems of the program;

viii. it monitors the activity of project planning and construction organizations serving the program;

ix. jointly with local soviets of people's deputies and interested departments it settles the question of shaping the balance of labor resources and sources of food.

The program's management reports on its activity to the commission of the USSR Council of Ministers.

The Scientific Council of the USSR Academy of Sciences coordinates the scientific research projects of institutes of the academy and of sectors and industries related to carrying out the program for economic development of the BAM Zone, and it has the following functions:

i. it drafts the coordination plans for the 5-year period and submits them for approval to the Presidium of the USSR Academy of Sciences and to the Committee of the USSR Council of Ministers for Science and Technology;

ii. in the process of carrying out the program it raises questions that require additional basic and applied research;

iii. it conducts field sessions and conferences jointly with representatives of organizations participating in carrying out the program and also representatives of party and Soviet agencies and discusses the current problems in the further staging of the program;

iv. on the basis of the field sessions and conferences it prepares constructive proposals for policymaking bodies and planning agencies;

v. it participates in preparing recommendations for accomplishing the measures of the BAM program in successive planning documents.

The head project planning institute does the general project planning, establishes communications with the project planning institutes of sectors and industries insofar as concerns definition of the general strategy for formation of TPK's and solution of problems of the entire program, it drafts the plan of project planning work for the next 5-year period, taking into account creation of the necessary project planning spadework for subsequent phases in carrying out the program, jointly with the general contractor it works out the network schedule for preparation of project plans and estimates, it performs expert evaluation of materials prepared by subcontracting organizations, evaluating the quality of this documentation, and it defines the technical policy of construction organizations, including the questions of interchangeability of various materials and fabrications.

The general contractor, to be designated by the Commission of the USSR Council of Ministers for the BAM Program from among leading construction ministries, is responsible for development of the construction and building materials industry, including the support facilities of subcontracting organizations, and for maintaining communications with the program's management and with the material and technical supply administration, jointly with the head project planning organization it evaluates the quality of incoming documentation and technical policy and principles governing location of the construction and building materials industry, selects progressive forms and methods of construction to take into account the specific regional features of the zone, and sets up the computerized system for management [ASU] of development of TPK's and projects significant to the entire program.

The functions of supplying appropriations and credit to finance the program's projects are made the responsibility of offices of USSR Stroybank, which must be guided in their activity by the decree on improving planning work and perfecting the economic mechanism adopted 12 July 1979 by the CPSU Central Committee and USSR Council of Ministers.

It would be wise for a specially created administration subordinate to the Committee for Material and Technical Supply of the USSR Council of Ministers to bear responsibility for physical balancing of the program's measures. The material and technical resources of ministries and departments covering the entire period of the program's fulfillment would be transferred to it on a centralized basis. The administration would compile the specification of required physical and technical resources and their distribution among the supplier enterprises manufacturing them.

Regional administrative structures would take the burden of forming labor resources, food supply, forming the balance of local building materials and developing branches of the building materials industry, and solving problems concerning housing, utilities and social and cultural services. They would also examine and approve the general plans of cities and worker settlements and monitor their fulfillment and participate in working out draft versions of multiannual and current plans for carrying out the program's measures.

The Council of the Program, which functions as an advisory body of the program's management, is created to resolve intersector problems and problems lying outside the program posed by representatives of the organizations enumerated above. It must be accorded broad functions in taking decisions that determine the progress of the program's fulfillment: this applies both to scientific-technical and project planning aspects as well as to selection for each successive phase the most expedient alternative that suits the conditions that have come about and reflects the interests of attainment of the program's intermediate and ultimate goals. The council establishes and maintains ongoing contact with the interested regional and sectoral organizations.

Elements of the target-program approach were used from the very beginning of elaboration of the economic program of the BAM in the domain of management. Unfortunately, this progressive approach extends only to construction of the main rail line itself. As a result even at the present time a number of disproportions have been planned in the development and location of the construction and building materials industry, in urban development and in formation of the regional infrastructure for both production and social services and utilities. It is obviously important to take the ideas of target-program management to their logical end.

Regional programs are intersector programs, and when they are being carried out, the question always arises of priority measures related to pioneering capital investment, i.e., resources aimed at laying the foundation of the region's economy, formation of the elements of the production and social infrastructure. So that a situation will not come about in which each department, starting from its own limited resource capabilities, will strive to become involved in carrying out the program in phases which are no longer related to pioneering capital investments, it is advisable that in each program a separate section be devoted to the work of creating the intersector infrastructure of production and social services and utilities. In order to encourage the creation and operation of this separate component it would be justified to have centralized planning of all the resources set aside for these purposes and to concentrate them in the hands of the program's management. The respective work items must be included in the plan of the general contractor and relevant subcontractors.

The sequence for construction of these facilities and also the financing of material and technical supply for operations related to building them is set forth by the Council of the Program.

Since the program for economic development of the BAM Zone is being carried out in several oblasts, an office of USSR Stroybank has been created to afford the possibility of responsive settlement of questions of financing and to enhance material liability for fulfillment of the measures of the program. It is obvious that similar measures through the channels of USSR Gosbank would make it possible to regulate more actively the circulation of money, to furnish in good time the required short-term credit and to react through fulfillment of the cash plan to discrepancies that arise between effective demand and the commodity counterpart.

There is a steady tendency on the part of the productive forces to move northward where the most important mineral deposits are located, and there is an urgent need to settle the question of active encouragement of the capital investment intentions of ministries and departments in carrying out programs that are scheduled in those areas. Experience shows that fulfillment of planning targets when capital investments are limited is easier if they are committed to areas already developed and not burdened with factors that mean higher costs. To some extent this is the reason why the eastern regions are developing slower than is required by the interests of the national economy. It obviously would make some sense to raise the question of government compensation of additional capital investments in areas of new development resulting from the factors that increase costs; this would make it possible to enhance the attractive attributes of pioneer areas for increasing the efficiency of capital investments in the functioning of future production operations.

Problems related to preferential financing with appropriations and credit, whereby benefits would be instituted to attract and hold labor resources and to raise the standard of living of the population, are also taking on great importance.

In order to derive the maximum benefit from program management, it is important to formulate straightforward rules governing relations with ministries and departments participating in carrying out the program and also with soviets of people's deputies within administrative formations where the capital investment process is taking place. We can identify four spheres of activity where the interests of program, sectoral and regional management tend to intercept one another most frequently: 1) satisfaction of the physical and cultural needs of the population; 2) creation of the production infrastructure and also of subsidiary and auxiliary intersector production operations; 3) comprehensive use of regional resources; 4) environmental protection.

The interrelations of sectors and industries participating directly in carrying out the program and performing related functions should be structured on the basis of the most important requirements those sectors and industries must meet in order to attain the ultimate goals of the program:

i. documented justification of the feasibility of participation in the relevant program in the various stages of carrying it out;

ii. a reckoning of the interests of the various sectors and industries involved in utilization of natural resources;

iii. a reckoning of temporary production and material-and-technical constraints in defining the structure and scale of production, and also proportions between live and embodied labor;

iv. selection of technological systems that suit the natural and climatic conditions and the mineral and raw material resources related to development of the production operations of the relevant sectors of the economy;

v. strict observance of the network schedule of the program, which presupposes that ministries and departments are ready to become involved in carrying out the program in the phase that corresponds to the logical sequence of its fulfillment in time;

vi. participation in scientific preparation and infrastructural development in the zone where programs are being carried out;

vii. timely examination of measures ensuring fulfillment of obligations in the drafting of long-range, medium-term and current plans;

viii. realization of the requirements of the program in compilation of plans not only to take into account the efficiency of the sector or industry in the time interval being planned, but also to take into account the need to attain the ultimate goals of the program and at the same time to minimize resources and time;

ix. preparation of project planning documentation so as to take into account the regional peculiarities of the program;

x. timely placement of orders with manufacturing plants for future enterprises and selection of the technical characteristics of machines and equipment, which are to be cleared with the respective entities involved in management of the program from the standpoint of savings of live labor and environmental protection;

xi. creation of a reliable construction and building materials industry in accordance with the program's scale, development of that industry in time according to the volume and structure of capital investments pertinent to each stage of the program;

xii. geographic location of the construction and building materials industry in accordance with the forms for spatial organization of the program;

xiii. transportation development of the area where the program is to be carried out so as to take into account the sequence it envisages for shaping regional industrial complexes and creation of conditions for shaping stable intraregional and interregional transportation-economic relations.

Within the framework of a reliable economic mechanism it is obviously possible to provide guarantees that the requirements of the program will be fulfilled in the practical activity of ministries and departments. To that end it is advisable to include the measures envisaged by the program in master charts of development and location drafted for each sector or industry, and priority work items should be given a separate line in its 5-year development plan. It is best for material and technical resources required to carry out the program to be transferred centrally to the general contractor of the program. This eliminates the possibility that the capital investments will be used for other purposes. The planning targets of sectors and industries related to fulfillment of programs should be cleared in this order: the sector or industry, the program's management--Gosplan. This will make it possible for the program's management, before the draft version of the plan has been examined by USSR Gosplan, to link the intentions of sectors and industries and to square them with the proportions and functional relationships established in the program.

Each sector or industry, pursuing its own interests, also advances its own requirements concerning the program: 1) that the sector's immediate and long-range interests be taken into account when the time sequence for shaping the program and the network schedule for its fulfillment are defined; 2) that the sector's or industry's future enterprises be provided local resources, taking into account the right to preferential use arising out of the role and importance of the sector or industry in the system of the USSR national economy; 3) that intersector production operations be developed to meet the needs of the program's participants for repair and other material services; 4) that reliable sources of fuel and power be created so as to cover the needs of every industry and sector as they grow; 5) that a unified transportation system be created to serve the needs of the program, taking into account the volume and composition of shipments and the economic interests of each participant in the program; 6) that the position of the program's management concerning the proposals of the sector or industry concerning regional organization of the economy, architectural and layout solutions, the principles governing settlement and material and technical supply be defined in good time; 7) that the interests of the sector or industry be taken into account when regional policy is defined concerning formation of the balance of labor resources and the programwide technical and technological strategies.

If the program is to be able to vigorously influence the socioeconomic development of oblasts, krays and republics where it will be carried out, it is extremely important that it a) take into account the interests of those administrative entities, which might take the form of reckoning on mutual requirements, development of construction support facilities, formation of the balance of labor resources, creation of conditions for building the infrastructure of utilities, and so on; b) make provision for the necessary resources intended for development of local facilities making up the infrastructure of production and of social services and utilities; c) participate in the process of settlement and urban development; d) take into account the possibilities of its participation in reconstruction of existing enterprises which will be involved in carrying out the program; e) take into account the initial economic level of the oblast and its change under the impact of the program's implementation and mandatory identification of the economy under local jurisdiction; f) make provision for distribution of capital investments among administrative entities so as to take into account the sequence of carrying out the program in accordance with the general network schedule for its fulfillment.

The program is linked to the plan of oblasts, krays and republics by bringing the volume of capital investments into line with the plan for development of the building materials industry, by linking the social aspect of the program with the plan for social, cultural and consumer services to the public of the oblast (kray), and bringing the scheme for movement of commodities for production and consumer needs into conformity with the existing schemes and prospects for their development. In addition, the program's environmental protection measures are linked to the corresponding sections of regional medium-term plans, and the necessary compensatory measures are unfailingly taken into account.

One can distinguish three interrelated areas where comprehensive regional programs also exert a socioeconomic impact.

1. The area whose economic development comes under the influence of actual realization of the program. Its size depends on location of the prospected resources and possibility for bringing them into economic circulation over the next 15-20 years. Work to augment the raw materials potential and to shape TPK's, industrial parks and a network of urban settlements around it, to build the infrastructure of production and social services and utilities, and to develop the nonproductive sphere and the sectors providing trade and consumer services to the public undergo further development in this zone.

2. Areas of oblasts, krays and ASSR's adjoining the zone where the program is being staged. They become support bases for staging construction work, a source of personnel, and a source from which the construction project receives material and technical supply and a source of trade and consumer services. Moreover, these administrative entities bear the principal load in shaping the balances of farm products for the public, in location of repair facilities, in setting up multipurpose facilities for classifying the assortment of goods required for material and technical supply of the economy and to furnish consumer goods to the public, in using the finance-and-credit system to serve the cost-accounting functions of enterprises and organizations and to regulate the circulation of money in the area mentioned under 1.

3. All other economic regions of the country which are actively participating in scientific preparation, project planning and construction of industrial enterprises and infrastructural facilities and formation of the financial and physical resources required for carrying out the program in practice.

As a function of the type of economic connection the program has with the areas mentioned above, the content of planned production dependencies and mechanism for regulating them are defined. Whereas full responsibility of the program's management bodies for construction of the facilities of the production and social-residential infrastructure and for development of intersector subsidiary and auxiliary production operations is typical of the first area, for the second and third participation in solving the production of socioeconomic problems of the program comes down mainly to allocating the necessary financial and material and technical resources under the condition that assignments are unfailingly fulfilled in accordance with the network schedule. After the work of forming the first area is completed, the facilities are transferred to the balance sheet of local soviets of people's deputies and organizations of the nonproductive sphere and other functional subdivisions of regional administrative agencies representing their interests.

The measures of the program take on active functions only when they are specifically assigned, i.e., when the organizations which are to carry them out are named and bear full responsibility for their performance by the dates set forth in the network schedule for performance of the program.

Since the measures of the program for economic development of the BAM Zone affect the interests of many sectors and industries, both those participating directly in carrying out the program with their own projects and also those performing related functions, the need arises to differentiate the requirements defining their mutual relations. As a function of the character of participation one can distinguish five groups of sectors and industries responsible for performance of a certain set of measures:

1. Sectors and industries participating in the scientific and geological preparation of the zone for economic development. They are the pioneers in development, and the soundness and promise of the decisions made depend largely on their activity. In addition, these sectors and industries conduct the scientific and geological preparation of the area, which makes it possible to work out sound standards of behavior for subsequent waves of development. The content and scale of the measures to be performed by these departments must be in correspondence with other components within the framework of the overall program.

2. Sectors and industries participating in attaining the ultimate goals and in performing the intermediate tasks of the program. They can be put in the category of program-forming sectors, since they determine the national economic orientation and spatial organization of the program. The

measures outlined for this group of sectors and industries are based on the results of performance of the measures of the first group of sectors and industries, whereby continuity of action is achieved in carrying out the program. Compatibility of the measures in time and space is an unfailing condition for this. For instance, if the process of studying seismic regions and the development of antiseismic measures are conducted with a certain lag or in regions which do not have priority for economic development, synchronization in the unfolding of the program in space and time will be disrupted.

3. Capital goods sectors and industries, which are functioning both in the zone where the program is being carried out and also outside it. These sectors and industries, which are carrying out the orders of the bodies for management of the program, must take into account the regional conditions under which the machines and equipment they manufacture will be operating and also the geography and time when they will be used in practice.

4. Infrastructural sectors and industries important both to the entire program and also of local importance. As a rule the unfolding of the program begins with their development, i.e., development of the area's transportation system, creation of sources of production and facilities for transmission of electric power and heat, development of means of communications, and so on.

5. Sectors and industries carrying out measures related to furnishing the population with food, consumer services and health care, housing and utilities and other services.

It is an unfailing condition for effective realization of the program that there be guarantees of compatibility and synchronization of the measures planned and that resources of all kinds be allocated by the specified dates.

The financing of the measures for economic development of the BAM Zone is best planned in this breakdown: a) the financing of ministries and departments participating in carrying out sectorwide and intersector projects; b) the financing of the most important scientific-technical and socioeconomic measures; c) the financing of regional industrial complexes and industrial parks being formed as the program is carried out; d) the financing of regional administrative entities.

This procedural approach will make it possible to link and balance program planning with the sectoral and regional planning that already exists and also to obtain an overall financial evaluation of the program as a whole and of its individual phases.

In solving the problems of materia' and technical backing of the program it is indispensable to determine the machines required and to equip technical schools to provide specialists in the most common occupations for the sectors of the economy.

In view of the complicated demographic situation that will come about and also the high cost of providing amenities for every person, it is indispensable to abide strictly by the principle of saving on live labor when technical projects are being assessed and when models and sizes of machines are being selected.

The use of manual labor should be looked on as something exceptional in the practice of the economic development of the BAM Zone, requiring a special permit from the Committee for Labor and Social Problems, one of whose tasks is to make an expert evaluation of projects from the standpoint of estimating the labor intensiveness of the proposed technological systems.

Normative-and-Legal Soundness of Assignments and Indicators of the Program. The measures of the program take on real force when they are expressed in a system of quantitative and qualitative indicators. They must, moreover, correspond to the indicators of multiannual state plans and must be justified in the system of analytical calculations.

The indicators of the first phase of carrying out the program should be detailed to the level of the indicators of the approved 5-year plan in its breakdown by years, and the indicators of the second phase are best represented in more consolidated form, but both should be included in the main lines of economic and social development of the country, of individual sectors and industries and of regional administrative entities. The indicators of the third phase, which are based on scientific research developments, are subject to revision and detailing and are included in the relevant planning documents. It is obvious that the indicators of this phase will be subject to correction under the influence of performance of the first two phases, as well as under the influence of scientific-technical advances and the actual spadework achieved.

The indicators should be put in the most important groups as follows:

First, indicators of the program product, which include the volume of production at the end of the last year of each phase (coal mined, timber felled and skidded, production of forest products, ore mined, concentrate produced, electric power generated, and so on); the volume of shipments of the most important types of freight; activation of the production capacities of enterprises and utility installations; volume of production and consumption of heat and electric power; growth of total geological and commercial reserves of deposits of mineral raw materials; the volume of physical services; the production of the most important products of livestock raising and plant growing.

Second, indicators of capital construction: ceilings on capital investments by phases in a sectoral and regional breakdown; itemized lists of the most important projects, and the volume of partial completion of capital construction; the growth of production capacities of the construction and building materials industry; ceilings on capital investments for construction of production and nonproduction facilities; the distribution of nonproductive capital investments among the phases in the program's realization; total capacity of construction contractors at the beginning and end of each phase as compared to the total need for the product of construction.

Third, indicators related to the financial resources required for preparation and accomplishment of the investment process: outlays which will be made in the BAM Zone itself and assigned to construction of the railroad itself and to formation of TPK's (representing 70-75 percent of all outlays); outlays to create supporting auxiliary production operations and agricultural facilities in the southern areas (for instance, plants at Tayshet, Ulan-Ude and Khabarovsk will undergo reconstruction for the repair of rolling stock, and plants of the construction fabrication industry will be built in these areas); outlays which must be made in other areas of the country in order to build the material and technical base and prerequisites called for by scientific designs for carrying out the entire program.

If we examine total outlays from the time standpoint, then the logic of economic development puts priority on those outlays related to conducting scientific research projects, geological explorations and project planning and surveying as well as outlays related to shaping the infrastructure of the entire zone.

It would be sound not to distribute resources for these purposes uniformly by 5-year periods, but to assume that there must be faster rates of creation of housing and residential conditions and development of the infrastructure of the area for economic development, concentrating resources for this in the first and second phases of the program.

Since the program for economic development of the BAM Zone can be carried out only with the active help of local Soviet and party authorities, it would be wise to examine resources also in a breakdown by administrative divisions so that each oblast would have an idea of the scale of the capital investment program to be carried out in its jurisdiction. This will make it possible to link the tasks of economic development with the overall tasks for development of the oblast and to utilize unused potential for speeding up the process of carrying out the comprehensive program.

Those indicators which reflect the social problems of labor resources have an important place in the system of indicators. When particular technical-and-economic solutions are chosen, consideration should be given to the shortage of labor resources and to the costs of moving workers from other areas of the country. We are referring to the need to minimize outlays of live labor, and that means that it is important that capital investments aimed at saving on live labor and also at alleviating difficult working conditions should be envisaged in all design solutions and in the overall cost estimates of enterprises scheduled for construction.

ASPECTS OF EXPERT GEOGRAPHIC EVALUATION OF THE DATA SUPPORT OF COMPREHENSIVE REGIONAL PROGRAMS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 31-37

[Paper by K. P. Kosmachev, Institute of the Geography of Siberia and the Far East of the Siberian Department of the USSR Academy of Sciences, Irkutsk]

[Text] Success in carrying out comprehensive regional programs depends in large part on the adequacy of the resources backing them up, including data resources. As a rule resources "are not the result of activity within the framework of the program, but bear the relation of external parameters to it."[1] Since in the case under consideration here we are referring to a special type of program--a regional program, one of the most important external parameters when it is being drafted is spatial information, which "indicates the spatial distribution of elements and attributes and the relationship among elements located at different places."[2] The search for ways of improving the quality of spatial information is taking on particular urgency in this connection. It is of paramount importance to attaining this goal that there be a check of the objectivity and completeness with which the information used reflects the space-time peculiarity of regional systems being shaped in the process of the interaction of nature and society. Since geographers look upon these systems as basic subjects of research, the idea was formed of developing a separate field of science that would specialize in checking the objectivity of the way patterns of development of integrated systems of the "population--economy--nature" type are reflected in specific solutions in order to define ways of increasing the effectiveness of regional organization of production, including the problems of optimum utilization of spatial combinations of resources and protection of the environment. This field has come to be called expert geographic evaluation.

Its development has beer mainly assured by the system of methods that has taken shape in geography. Among them comparative geographic and cartographic methods and the regionalization method are especially important.

Matters are more complicated with selection of the subjects of geographic evaluation, their range being extremely broad. For example, both individual project plans and also combinations of them related to development of particular complexes of natural resources, creation of systems of the latter, main transportation routes and other installations should be subject to expert geographic evaluation from the standpoints described. This assessment may unquestionably reveal certain shortcomings, as a rule related to incomplete reflection of the singularity of the local conditions of the specific areas in the features of the project plans. But, as experience shows, there are general reasons for these shortcomings. The main one is the use of concepts whose definitions do not reflect accurately enough the conditions under which specific regional systems develop.

It is this that has compelled us to regard those subjects of greatest importance whose evaluation makes it possible to discover not the individual shortcomings of the data support of solutions, but those which are most common and most often repeated: more precisely, not so much the shortcomings themselves as the reasons for their occurrence. It therefore follows that systems of concepts must be among the priority subjects of expert evaluation, since it is they which "perform the role of the initial logical skeleton that sets the limits of the topic to be studied and sets down the basic scheme of its analysis."[3]

Experience confirms that distortion of this skeleton inevitably detracts from the quality of spatial information. This compels the expert to thoroughly see how accurately the system of concepts used reflects the totality of the most essential regional characteristics of development of the complex regional systems. As a result of this check the level of correspondence of the systems of concepts used to the objective natural and economic conditions of regions for which decisions are being made can be essentially improved.

If this goal is to be achieved, a number of procedures for expert geographic evaluation of the concept base need to be developed. They would be based on classification of the causes of diminished quality of spatial information resulting from the use of concepts that do not reflect accurately enough specific aspects of the objective reality of specific areas.

Familiarity with the proposed classification, which we substantiated in one of our papers published recently,[4] makes it possible for the expert to develop the particular "angle of vision" required to get a better view of the shortcomings of the concept base. Research has shown that among the most widespread shortcomings of the concept base of regional organization of production is certainly the use of concepts which do not have generally recognized definitions as standard concepts in comparisons. Those used most frequently in preparing spatial information are the concepts of the "middle zone," "middle-latitude areas," etc. The reason why they are so necessary is that "in any analytical work there is a need for indicators of the average level."[5] This compels the expert to look with particular strictness on the soundness of use of the word "middle" comparisons of various kinds. Expert evaluation of a large number of sources has shown that authors using the term "middle zone" are usually and essentially referring to areas which are not comparable, so that this concept cannot be used in comparisons because of its indeterminacy. But comparisons of this kind are still quite widespread.

For example, we are told in an article by S. A. Khazanskiy and G. P. Belova that "approximately 25 percent more tractors are needed to perform the same work in the North as in the middle zone."[6] Because of the indeterminacy of the term "middle zone," it is impossible to determine this need. In other sources[7] the level of development of particular phenomena (the fuel and power industry, the infrastructure) within certain areas of the North (the city of Noril'sk and the Yamalo-Nenetskiy Autonomous Okrug) is compared to the conditions of the "middle latitudes." The question is which areas the conditions of the middle latitudes are characteristic of. For instance, in the USSR the middle latitudes (23.5-66.3° N latitude) include on the one hand Central Asia and the Transcaucasus, and on the other the areas of the northeast of the RSFSR (Yakutskaya ASSR and Magadanskaya Oblast). Consequently, "incomparable comparisons" of this kind do not help to elucidate the patterns under consideration, but rather to "cloud them over."

Areas rather typical of decisions to develop new areas are related to the use of concepts from other regions which were formulated after summarization of experience acquired in one part of the country, but they are applied in another without the necessary revisions of the particular definitions, though the other area differs sharply from the first in the entire set of economic and natural conditions. Coming upon such a concept, the expert should first of all estimate how large are the differences between the regions of its "input" and "output," remembering that the greater the probability that errors will occur in use of this concept, the more sizable they will be.

For example, the concept "summer pasturage of livestock," which reflects the peculiarities of keeping livestock in the steppe and mountain regions located in the south, is sometimes used to solve problems in development of reindeer herding--a typical economic activity in the north. Usually it has to do with rates of remuneration of herders. In summer pasturage areas, these rates are more differentiated than in the areas of reindeer herding, which makes it possible to give closer consideration to the effect of local conditions on the work done by the population. For example, in the areas of summer pasturage those occupied in attending livestock on summer pastures from May to November are paid at wage rates raised by 40 percent. This was later transferred to the principal reindeer herding regions of Yakutskaya ASSR, which made it possible to considerably raise the remuneration of reindeer herders in those months. But one important peculiarity was not taken into account in this: the more difficult period for reindeer herders is not the period from the spring to the autumn, but the winter.

Because of this seasonal discrepancy between wage levels and the "peak difficulty" in the work and living conditions of the reindeer herders, additional obstacles are created to obtaining reindeer herders, which is one of the principal reasons for the operational breakdowns characteristic of socioeconomic production systems characteristic of the reindeer herding areas.

Possibilities of detecting other types of discrepancy between the concepts used and the conditions of specific areas we described in detail in a specific article,[8] so that we will not dwell on them here. Here we will note that the proposed classification can serve as the basis for developing other procedures of expert geographic evaluation. Among them we should mention first of all expert evaluation of geographic comparisons. It is particularly necessary for improving the quality of data preparation of regional programs for territories to be developed for the first time, since the specialists involved in solving a broad range of problems in the economic development of virgin regions are concerned more frequently than their colleagues with studying the areas that have been developed and have occasion to come up against an acute shortage of spatial information. This forces them to make extensive use of the comparative method to obtain the data they lack.

In checking the soundness of comparisons which have been made, the expert should above all take as his point of departure the principle that "this method is used in the case when the relevant concept can be compared to other concepts like it, and the given phenomenon better explained as a result of that comparison."[9] But, as was previously established,[10] the selection of standards at the level of concepts is not always substantiated as it ought to be, which is an important reason why use of the comparative method is yielding lower results.

We will attempt to demonstrate this principle by taking sample articles of authors who used in comparison the "middle (central) zone," which, as we have already said, essentially refers to areas that cannot be compared to one another. For example, in defining the demographic capacity of an area the authors of the "Manual and Comprehensive Evaluation"[11] give the average value of the coefficient (0.5) calculated "for the central zone of the RSFSR," cautioning that "in other regions of the country it could change essentially."[12] This advice cannot be followed in practice, since it is not clear what areas are included in the "central zone of the RSFSR." This kind of vagueness can in turn be a source of serious errors, since because of the indeterminacy of the boundaries of the "central zone" areas where this coefficient must "change essentially" might be arbitrarily included in it.

Another example. According to the data of A. Khaytun, "it costs 21,000 rubles in capital investments to 'set up' one person in the northern regions, i.e., 4-6-fold more than in the middle zone of Russia."[13] It follows that sizable differences in the costs of setting up one person are in turn observed within the "middle zone of Russia," which is vague as to its regional makeup. This makes it still more difficult to use the "middle zone of Russia" as a standard in comparisons. Certain authors who are aware of this shortcoming try to define more accurately the border of the "middle zones" they have in mind. For instance, in the collective monograph "Labor Resources ..."[14] the "middle zone of settlement" (50-55° N latitude) is identified within the limits of the USSR. Sometimes the data used in comparisons pertain to the areas "of the moderate zone--from the 40th to the 60th parallel of north latitude."[15] But even within these boundaries, which at first would seem "more precise," there is a very "varied" area, which includes on the one hand a sizable portion of the Ukraine and Belorussia and on the other the mountain-taiga areas of Transbaykalia, the Far East and the northern portion of Sakhalin Island. The extreme indeterminacy of these zones does not allow their use as standards in comparisons, since it is difficult to obtain more or less sound averages for them.

The number of new requirements which expert geographic evaluation must meet follow from the decree of the CPSU Central Committee and USSR Council of Ministers adopted 12 July 1979 and entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality." One of them is verifying in a regional breakdown the linkage between the solving of long-range and current problems.[16]

We based this check on a specific study of Irkutskaya Oblast aimed at identifying within its borders those rayons which differ from one another in the prospects for their development. An analysis of the papers of conferences and meetings on the study of the productive forces of Irkutskaya Oblast and Eastern Siberia as a whole and of other sources made it possible to select the most promising places in the oblast. Foremost among them is the Tayshet industrial park. It is generally recognized to have particularly favorable conditions for development of ferrous metallurgy, heavy machinebuilding and the chemical and other industries. The Tayshet industrial park came to be known as the site of greatest promise more than 25 years ago and it has held up until today. For instance, N. N. Nekrasov, member of the academy, gives Tayshet an important role in the development of ferrous metallurgy in the period up to the year 1990.[17]

At the same time, we should note that so far the potential for development of the Tayshet industrial park, as witnessed by the high assessments of its promise, has gone practically unrealized. Moreover, the "high degree of promise" is beginning to hold back the economic growth of Tayshetskiy Rayon. The reason is that the better industrial sites within it have been reserved for construction of the metallurgical combine. At the same time it follows from the development projects that are available that all the basic outlays to shape the Tayshet industrial park and above all its very expensive infrastructure are to be made by the Ministry of Ferrous Metallurgy. In that situation other ministries prefer to wait until requisite conditions are created for construction of their enterprises there. As a result the development of one of the most promising industrial complexes in Irkutskaya

Oblast is lagging behind considerably, and this is having an adverse effect on all aspects of its economy and has even resulted in a reduction of the total population of Tayshetskiy Rayon in the period between 1959 and 1979. This latter fact deserves particular attention, since population (level of development of an area, the adequacy of labor supply, and so on) is becoming that resource on which the prospects for comprehensive development of particular areas, especially those located in the country's east, are coming to depend more than on others.

To summarize what we have said, we can include Tayshetskiy Rayon among the promising, but underdeveloped regions. One of the principal reasons why there are such regions is lack of coordination in solving long-range and current problems in development of the productive forces.

It is an important task of an expert geographic evaluation to discover areas for which a high degree of promise may become an evil rather than a benefit because of the shortcoming we have noted. In the light of what we have said the expert should look with particular attention to see how prospects for development of the productive forces of areas are taken into account in the drafting of various manuals and guides that have great importance in the preparation of initial information for comprehensive regional programs.

By way of confirmation we will examine the "Manual on Regionalization of an Area for Purposes of Regional Land Use Determination."[18] It observes: "Since correct regional grouping of production operations, the shaping of an integrated system of settlements and creation of unity in layout are principal tasks in regional land use determination, economic microareas can and should be the subjects of regional land use determination, of its second phase--draft versions of the regional layout."[19] It is accordingly proposed that 13 microareas (see the table) be examined as subjects in compiling draft versions of the regional layout in Irkutskaya Oblast.[20]

Economic Microareas	Cities Under Republic, Kray, Oblast and Okrug Jurisdiction (administrative rayons)	Area, in thousands of square kilometers	Population, in thousands		
			Total	Urban	Rural
Irkutsko-Cheremkhovskiy	Irkutsk, Angarsk, Usol'ye-Sibirskoye, Shelekhov, Cheremkhovo (Irkutskiy, Usol'skiy, Cheremkhovskiy, Slyudyanskiy)	38	1,199	1,094	105
Ust'-Ordynskiy	(Aparskiy, Bokhanskiy, Nukutskiy, Ekhirit-Bulagatskiy, Bayandayevskiy, Osinskiy)	22	134	26	108

Economic Microareas	Cities Under Republic, Kray, Oblast and Okrug Jurisdiction (administrative rayons)	Area, in thousands of square kilometers	Population, in thousands		
			Total	Urban	Rural
Ziminskiy	Zima (Ziminskiy, Zalarinskiy, Kuytunskiy)	26	153	72	81
Ol'khonskiy	Ol'khonskiy	16	9	1	8
Tayshetskiy	Tayshet (Tayshetskiy, Chunskiy)	54	151	105	46
Tulunskiy	Tulun, Nizhneudinsk (Tulunskiy, Nizhneudinskiy)	63	186	124	62
Bratskiy	Bratsk (Bratskiy, Ust'-Udinskiy)	60	332	259	73
Ust'-Ilimskiy	Ust'-Ilimsk (Ust'-Ilimskiy, Nizhneilimskiy)	55	133	102	31
Ust'-Kutskiy	Ust'-Kut (Ust'-Kutskiy, Kazachinsko-Lenskiy, Kirenskiy)	117	101	73	28
Verkhnelenskiy	(Kachugskiy, Zhigalovskiy)	54	35	14	21
Yerbogachenskiy	(Katangskiy)	139	5	--	5
Bodaybinskiy	Bodaybo (Bodaybinskiy)	92	32	29	3
Mamsko-Chuyskiy	(Mamsko-Chuyskiy)	43	21	20	1

Familiarity with this regionalization chart and the explanatory materials accompanying it convinces one that it does not properly reflect either the level achieved in spatial differentiation of the productive forces of the Irkutskaya Oblast, nor the prospects for their development. For example, the level of economic development achieved by the Tayshetskiy microarea, according to the typology given in the "Guide ...," is equal to the levels of the Yerbogachenskiy and Ol'khonskiy microareas, with which we cannot agree at all. This oversight in defining the type of microareas can have an adverse effect on the economic substantiation of draft versions of regional layouts, with all the undesirable consequences that derive therefrom for organizations using that information. In preplanning development work known to us the Bratskiy and Ust'-Ilimskiy administrative rayons are usually regarded as the nuclei of the Bratsk--Ilimsk TPK. To consider this nucleus in different microareas (Bratskiy and Ust'-Ilimskiy), as is done in the "Guide ...," eliminates those problems which can be solved only within the boundaries which have objectively taken shape for the nucleus of the TPK. Nor does the "Guide ..." make an assessment of the prospects for development of the microeconomic areas it identifies. However, this is altogether indispensable, since a consideration of prospects usually compels one to revise the network of microareas, including a revision consisting of annexing areas of the less promising areas to more promising ones. In this respect, for example, we are more than doubtful about the "promising independence" of the Yerbogachenskiy and Verkhnelenskiy areas distinguished in the "Guide ...."

Summing up what we have said, we come to the conclusion that the level of information support of comprehensive regional programs can be raised substantially by developing expert geographic evaluation.

FOOTNOTES

1. "Matematika i kibernetika v ekonomike. Slovar'-spravochnik" [Mathematics and Cybernetics in Economics. Dictionary-Reference], Moscow, Ekonomika, 1975, p 447.

2. Germansen, T., "Information Systems for Planning: Issues and Problems," in the book: "Novyye idei v geografii" [New Ideas in Geography], Issue 2, Moscow, Progress, 1976, p 196.

3. Blauberg, I. V., and Yudin, E. G., "Stanovleniye i sushchnost' sistemnogo podkhoda" [Evolution and Essence of the Systems Approach], Moscow, Nauka, 1973, p 181.

4. Kosmachev, K. P., "Expert Geographic Evaluation of the Quality of Information Resources," in the book: "Problemy territorial'noy organizatsii narodnogo khozyaystva vostochnykh rayonov SSSR" [Problems of the Regional Organization of the National Economy of the Eastern Regions of the USSR], Irkutsk, 1977, pp 25-45.

5. Donda, A., Gerde, Ye., Kun, O., and Shtruk, R., "Statistika" [Statistics], Moscow, Statistika, 1974, p 135.

6. Khazanskiy, S. A., and Belova, G. P., "On the Building of Tractors for the North," in the book: "Problemy Severa" [Problems of the North], Issue 17, Moscow, 1917, pp 165-168.

7. Semkina, L. M., "The Role of the Social Infrastructure in the Emergence of the New Center of Gas Production," TR. TYUMEN. INDUSTR. IN-TA, Issue 30, Tyumen', 1974, pp 152-158.

8. Kosmachev, K. P., "New Approaches to Improving the Data Base of the Process of Development," in the book: "Teoriya khozyaystvennogo osvoyeniya territorii" [The Theory of Area Economic Development], Irkutsk, 1979, pp 5-30.

9. Kondakov, N. I., "Logicheskiy slovar'-spravochnik" [Encyclopedic Dictionary of Logic], Moscow, Nauka, 1979, p 569.

10. Kosmachev, K. P., "Expert Geographic Evaluation of Quality ..."; and by the same author: "New Approaches to Improving ...."

11. "Rukovodstvo po kompleksnoy otsenke i funktsional'nomu zonirovaniyu territoriy v rayonnoy planirovke" [Manual for Comprehensive Evaluation and Functional Area Zoning in Regional Land Use Planning], Moscow, Stroyizdat, 1979, 94 pp.

12. Ibid., p 12.

13. Khaytun, A., "Interregional Utilization of Labor Resources," VOPROSY EKONOMIKI, No 8, 1979, p 54.

14. "Trudovyye resursy: formirovaniye i ispol'zovaniye" [Labor Resources: Formation and Use], Moscow, Ekonomika, 1975, p 35.

15. IZVESTIYA, 26 October 1979.

16. KOMMUNIST, No 12, 1979, p 4.

17. Nekrasov, N. N., "The Master Chart and Reality," EKONOMIKA i ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, No 4, 1979, pp 42-63. This article summarizes the principal results obtained by the staff of the Council for Study of the Productive Forces of USSR Gosplan in drafting the master chart for location of the productive forces of the USSR.

18. "Rukovodstvo po rayonirovaniyu territorii dlya tseley rayonnoy planirovki" [Manual for Area Regionalization for Purposes of Area Land Use Planning], Moscow, Stroyizdat, 1978, 64 pp.

19. Ibid., Section 2.18, p 5.

20. Ibid., pp 56 and 57.

EXPERIENCE IN PREPLANNING STUDIES OF SIBERIA'S TPK'S*

DIRECTIONS IN IMPROVING PREPLANNING PREPARATION AND PLANNING AND MANAGEMENT OF THE PROCESS OF FORMING TARGET-PROGRAM TPK'S

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 38-59

[Paper by M. K. Bandman]

[Text] The desire to increase the efficiency of the process of solving major regional problems made it expedient to use a specific form of spatial organization of the productive forces--target-program regional industrial complexes (TPK's).[1] Examples of TPK's of this kind are the Bratsk--Ust'-Ilimsk, the Middle Ob', the Mangyshlak, etc. An analysis of experience in building complexes like these has shown that all the problems related to organizing the process of their formation have not yet been solved. For example, in an article devoted to the priority tasks of the Sayan TPK in the 11th Five-Year Plan shortcomings typical of the organization of the process of forming other complexes were also noted:[2] 1) changes of construction dates during the current 5-year period, in the makeup of the projects, in their specialization and even the dropping of facilities from itemized construction lists on the basis of unilateral departmental decisions (including the facilities which have significance to the entire complex); 2) failure to meet deadlines for capital investments to be allocated to build particular principal facilities of the TPK, reduction of such investments and sharp fluctuations in them from year to year; 3) isolated examination and differing thoroughness of treatment of the prospects for formation of the individual elements of the TPK; 4) underestimation of the significance and limited nature of types and sources of resources (mainly multipurpose resources--land and water), resulting in an unstewardly attitude toward them; 5) underestimation of the specific conditions of areas with a labor shortage in determining the possibility for location of labor-intensive production operations oriented toward use of female labor; 6) absence of conditions for an infrastructural preparation of the area in advance of the principal construction, a lag in the pace and disruption of overall integrity in building infrastructural facilities because of imperfect forecasting and 5-year and current planning, because of dependence on application of funds by industrial ministries, and because the present mechanism of monitoring adherence to deadlines and proportionality in development of the infrastructure is not effective enough.

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* This section was prepared by the staffs of the sectors for TPK formation, regional economics and Siberia's comprehensive regional problems of the Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences. Previously we have published several articles in our journal which we can regard as an integral part of this section. Namely: Bandman, M. K., "Target-Program Regional Industrial Complexes (Definition, Specific Features, Makeup, Boundaries and Content of the Task of Optimalizing the Process of Their Formation)" (Issue No 3, No 11, 1978); Gukov, V. P., and Belyayev, A. A., "Second Phase in Formation of the Bratsk--Ust'-Ilimsk TPK" (Issue No 1, No 1, 1979); Bandman, M. K., and Malinovskaya, M. A., "The Sayan Regional Industrial Complex" (Issue No 2, No 6, 1979); Burmatova, O. P., "Taking the Requirements of Environmental Protection Into Account in Optimalizing the Land Use Pattern of a TPK" (Issue No 1, No 1, 1979); Gukov, V. P., and Kaygorodtsev, A. N., "Prerequisites and Conditions for Formation of the Upper Lena TPK" (Issue No 3, No 11, 1979); Orlov, B. P., "The Middle Ob' Regional Industrial Complex: New Phase of Development" (Issue No 1, No 1, 1980); Klistorin, V. I., "Modeling the Social Service and Utility Infrastructure of the Academy Campus (Akademgorodok) in Novosibirsk" (Issue No 1, No 1, 1980).

Some of these shortcomings will obviously be eliminated by implementation of the decree of the CPSU Central Committee and USSR Council of Ministers dated 12 July 1979 and entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality."[3] The following measures envisaged by the decree have particularly great importance to improving the process of forming target-program TPK's:

1. Stabilization of plans, i.e., maintaining over the entire 5-year period the composition and volume of capital investments as approved and their distribution by years.

2. Drafting the program for formation and development of each complex, plans of contract work and capital construction and their linkage with the respective sections of the country's plan of economic and social development and with physical and financial resources.

3. Drafting charts of development and location of the productive forces of TPK's for Siberia and the Far East and also compilation of the principal indicators of economic and social development for each complex independently of departmental subordination of the associations (enterprises) and organizations, approval of those indicators and monitoring of their fulfillment.

4. Enhancement of the roles and plans and of the responsibility of USSR Gosplan and local administrative entities for organizing the process of TPK formation.

5. Amendment of the system for financing construction and for evaluation of the performance of construction organizations.

We can identify two principal directions in improving the process of creating target-program TPK's: 1) improvement of planning--developing a unified system or scientific, preplanning and project plan preparation and for planning the process of creating the complexes; 2) improvement of organization--definition of the juridical status of target-program TPK's, creation of management entities, development of an economic mechanism guaranteeing the motivation of ministries and departments to fulfill obligations in accordance with plans for building their projects and especially projects which have significance to the entire complex in accordance with plans agreed to in advance.

Research is being conducted in the IEiOPP SO AN SSSR [Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences] on the problems of forming Siberia's TPK's, on approaches to optimizing the structure of complexes, and also on work on one of the sections of the "regional plan" subsystem of the technical assignment and design sketch of the ASPR [computerized system of planning computations] of USSR Gosplan. As a result a certain idea is gradually taking shape concerning the documents which in our opinion are indispensable to preplanning studies and to the planning of target-program TPK's. These documents would include: the master chart, which would take up the conceptual questions of the TPK's formation, its production and spatial structure; the overall design, which contains the substantiation and coordination of technical designs related to production, to providing living conditions (obustroystvo) for the population and to environmental protection; the program for building the TPK, which covers the entire system of measures whose performance is indispensable to accomplishing the process of forming the complex; the 5-year and annual plans for building the TPK--documents regulating the process of building the TPK within the limits of the particular planning period (see Diagram 1).[4]

The master chart of the TPK is the principal general economic forecasting document covering a period of 20-25 years in the future. It is drafted on the basis of the target program for solving the major regional problem, whose implementation has led to formation of the TPK. It is assumed that the program and preliminary version of the master chart of location of the country's productive forces have already defined the goal of creating the TPK, its place in the regional division of labor, its size, and the time and rate of development of the principal sectors and industries in which the future complex would specialize.

The master chart of the TPK is intended for analysis of the proposed ways of achieving the goal and for concrete statement of those principles of the program for solving the major regional problem which determine the process of forming the TPK as a unified goal-directed system. Thus, among the documents proposed the TPK master chart performs on the one hand the role of a connecting link with the documents of the regional (the country's master chart), sectoral (charts for development of sectors and industries) and target-program (program for solving the major regional problem) aspects of planning the national level and on the other hand is the point of departure for drafting the preplanning and planning documents for formation of the TPK.

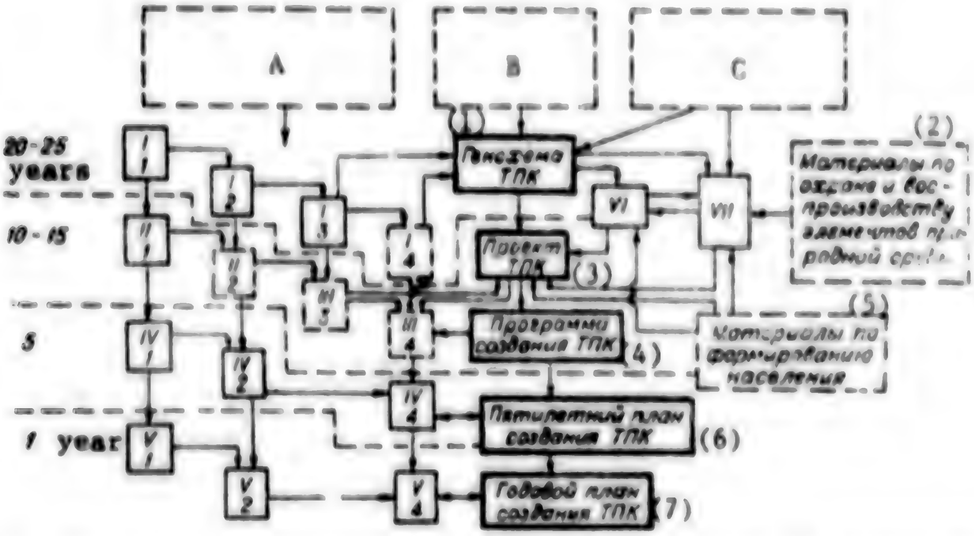
A
B
C
(1)
(2)
20-25 years
10-15
5
1 year
I 1
I 2
I 3
I 4
II 1
II 2
III 3
III 4
IV 1
IV 2
IV 4
V 1
V 2
V 4
VI
VII
Генсхема ТПК
Проект ТПК
(3)
Программы создания ТПК
(4)
Материалы по охране и воспроизводству элементов природной среды
(5)
Материалы по формированию населения
Пятилетний план создания ТПК
(6)
Годовой план создания ТПК
(7)

Diagram 1. Principal preplanning and planning documents of target-program TPK's and their place in the system of documents in multiannual planning. ▭--documents applying to all the subjects being planned, including ⁞⁞--those which are not drafted for all the units of the respective rank; ▭--documents for each target-program TPK. Documents: A--materials of policymaking and scientific organizations concerning the country's development strategy and conception; B--long-range target-program for solving the major regional problem; C--materials on development of interindustry complexes in the industrial sector, agroindustrial complexes and infrastructure of all-union significance. I--master charts of location of the productive forces; II--main directions of economic and social development over the long run; III--programs for resolving particular national economic planning or comprehensive development of the productive forces; IV-V--plans of the economic and social development of the national economy; VI--area land use schemes and plans; VII--comprehensive regional environmental protection schemes. Territorial units: 1--USSR, 2--union republics, 3--economic regions, 4--oblasts (krays), → --main lines of information flows.

Key: 1. Master chart of the TPK
2. Materials on protection and reproduction of elements of the natural environment
3. TPK project plan

Key to Diagram 1 (continued)

4. Program for building the TPK
5. Materials on formation of the population
6. 5-year plan for building the TPK
7. Annual plan for building the TPK

The TPK master chart contains alternative versions for creation of the complex under possible different external situations and for changes in the internal conditions of formation of the TPK, the basic parameters of the complex, versions of the production and spatial structure and connections, ways of attaining the intended living and working conditions for the population, for protecting their environment and for using new technologies. It is assumed that the schemes and projects for the area layout of the TPK and its individual parts, which are done by Gosstroy institutes of the USSR and of the union republics, will be prepared simultaneously in order to resolve issues related to the organization of the site, resettlement and analysis of the TPK's interaction with the natural environment.

Scientific institutes of USSR Gosplan or the gosplans of the respective union republics are assigned responsibility for drafting TPK master charts (depending on the problems). Kray (oblast) ispolkoms of soviets of people's deputies or councils of ministers of autonomous republics, and project planning and scientific organizations of ministries and departments are called upon. The TPK master chart is squared with charts of the location of the productive forces of the country as a whole and of superior units in the administrative division (union republics, economic regions, krays (oblasts)), USSR Gosplan makes an expert evaluation, and it is approved as an integral part of the target program for solving the respective regional problems to which formation of the target-program TPK is related (see the table).

The general project plan of the TPK is the principal preplanning engineering-and-economic document covering the next 10-15 years. It is assumed that it will summarize the results of engineering and economic computations and furnish specific technical solutions both for the individual facilities and also for the TPK as a whole. The point of departure for drafting the general project plan of the TPK is the TPK master chart, the project plans of respective sectoral institutes for the individual facilities of the TPK and the complex's area layout chart. The principal purpose of the general project plan is to link all the partial technical solutions both in the domain of technologies and interrelations among the elements of the TPK and also in the domain of "setting up" the population and protecting the environment. By contrast with the master chart the general project plan reflects not only the basic principles of technical [illegible] but also justifies specific technical solutions. The reason why the period covered is as long as 10-15 years is the need to select single-variant proposals that are realistically feasible and which can be taken into account in working out indicators for the TPK in the main lines of economic and social development of the country over the next 10 years. The period of 10-15 years also corresponds approximately to the cycle of pilot production and project planning work on new technologies already discovered.

For purposes of drafting the general project plan of the TPK the general project planner of the complex has to be designated--the organization which would not only draft the project plan, but would also exercise the drafter's supervision during the process of its implementation. It is assumed that this function would be undertaken by institutes of the system of gosstroy and, as an exception for complexes with very narrow specialization--by one of the project planning institutes of the specialized sector or industry.[5] The drafting of the general project plan of the TPK could make it necessary for some adjustment to be made in the master chart or area layout chart of the complex, of certain sectoral project planning solutions in order to state more precisely the location of individual facilities, the distribution of local resources, and the feasibility or possibility of carrying out the various technical solutions. After these documents have been squared with one another, the TPK general project plan should go through expert evaluation and approval at the level of the USSR Council of Ministers. It then becomes the principal initial document for drafting the program and 5-year plan for building the TPK.

The program for building the TPK is the second preplanning document for the complex and covers a period of 10-15 years. It is drafted on the basis of an analysis of the given TPK's place in solving the respective major regional problem, the principal parameters of the TPK outlined by USSR Gosplan, the master chart and the general project plan of the complex, and the list of measures for individual facilities to be performed by departmental institutes. The program for building the TPK should contain a list of the measures whose performance is necessary to the planned formation of the TPK as a whole, consideration being given to the specific conditions for solving social problems and protecting the environment.

By contrast with the general project plan, the program for building the TPK should presuppose the possibility of certain economic maneuvers being made and the process of building the TPK adapted in case of changes either in the external situation or the internal conditions for formation of the complex, which are discovered in drafting successive 5-year plans. For example, dates for attainment of the ultimate goal or assignments for individual phases in building the TPK may be changed, there may be changes in the pace or even sequence of building the individual facilities, etc. Thus, the program should ensure selection of an effective version for forming the TPK as a whole and its individual facilities with allowable deviations from the original version envisaged by the master chart and general project plan. The requirement of unconditional fulfillment of the assignment for the successive planning period and attainment of the final goal of building the TPK as defined in the program for solving the national economic problem as a whole and set forth in the complex's approved master chart and general project plan still remains mandatory. If the changes that have occurred are substantial and in drafting the program it becomes necessary to revise the master chart and general project plan, it is mandatory to return to those documents, and work on the program for building the TPK can be completed only after they have been adjusted.

It would obviously be best for the drafting of the program for building the TPK to be made the responsibility of the kray (oblast) ispolkom or ASSR council of ministers where the complex is to be formed. These bodies are on the one hand the most interested in a full reckoning of everything necessary to build the complex and on the other they have a better feel for the real local situation and specific conditions of the given TPK. But since many union ministries and departments are to be involved in drafting the program and since it will be necessary to resolve intersector issues, the role of organizer or coordinator of this work will probably go to one of the subdivisions of the USSR Council of Ministers, USSR Gosplan or to commissions for regional problems (we will discuss these commissions further on). Thus the aspects of forming target-program TPK's will be reflected in two interrelated programs at different levels: the long-range target program for solving the regional problem as a whole and the program for building the specific TPK. First we'll take up the entire set of fundamental problems (including the spatial organization of the economy) over the entire period of carrying out the program. The second, which is more restricted in its content and more specific and covers only the period of the long-range plan will consider the measures related to formation of the individual TPK. This system of interrelated programs for resolving major regional problems is, in our opinion, entirely in conformity with the July (1979) decree of the CPSU Central Committee and USSR Council of Ministers, which contains an explicit instruction to USSR Gosplan "... with the help of councils of ministers of union republics, USSR ministries and departments and the USSR Academy of Sciences draft programs for solving major regional problems and for shaping the most important regional industrial complexes."[6]

After its expert evaluation and approval, the program for building the complex becomes the basic initial document for drafting the principal indicators for the TPK, which USSR Gosplan includes in the main lines of the economic and social development of the country over the next 10 years, and for shaping the 5-year plan for building the TPK.[7]

The 5-year and annual plans for building the TPK are the principal planning documents for the complex as a whole; their purpose is to define the assignment and supervision over the process of attaining the goal which has been set, use of resources and proportional formation of all elements of the TPK in time and space. Neither the 5-year nor the annual plan for building the TPK replace, duplicate or eliminate the need for drafting the plans of economic and social development of the kray (oblast, ASSR) as a whole, including administrative rayons, cities and settlements within the area of the target-program TPK that is to be built within them. Plans for building the TPK, in our opinion, are an integral part of plans of the economic and social development of the kray (oblast, ASSR) and contain only those indicators which are directly related to creating the material and technical base necessary for solving the problem that has led to forming the TPK.

The 5-year plan for building the TPK is drafted after USSR Gosplan has determined the phases of solving the respective problem, the goal of forming the TPK over the next 5-year period, possible ceilings on capital investments and construction and installation work and the receipt of the principal scarce resources. Plans for building the TPK are drafted by local management entities by selecting from the program for construction of the TPK those measures which have priority and whose performance is necessary to attainment of the goal, for which the resources have been allocated, which have the necessary scientific and project planning spadework, the economic potential and the local (land and water) resources of the area.

The 5-year plan for building the TPK should contain the indicators (in a breakdown by years) of the volume of capital construction and construction and installation work, the list of projects and itemized list of enterprises and installations scheduled for construction and expansion, dates for activation of finished projects, ceilings on contract work with a breakdown by clients and contractors, the volume and sources of delivery of scarce resources and sets of equipment for projects near completion. Balances for labor and certain types of natural and physical resources, balances of production and services of the production and social infrastructure; a list of measures related to creating the intended conditions for the life of the population, environmental protection and reproduction of natural resources are drafted as annexes to the plan for building the TPK.

The plan for building the TPK is brought into conformity with the summary plan of capital construction and principal indicators of the economic and social development of the TPK, which are drafted by USSR Gosplan, the plans of ministries and departments (including supply, finance, bank and transportation authorities) and plans of economic and social development of the kray (oblast, ASSR) within which the target-program TPK is being formed. All indicators of the plan of economic and social development of the kray (oblast, ASSR) which are lacking in the plan for building the TPK shall also be worked out for the facilities of the complex. Data of the TPK plan are included in the summary indicators of the kray (oblast, ASSR), and the plan for building the complex is itself regarded as an independent section of the plan of economic and social development of the kray (oblast, ASSR) and is approved by the gosplan of the respective union republic. The plans for building target-program TPK's are given an independent section in the plans of union republics. Moreover, the principal indicators of economic and social development of target-program complexes are examined, approved and included in the USSR plan in the form of an independent item and their fulfillment is monitored by USSR Gosplan.

Participation of Ministries and Departments in Preplanning Studies, Forecasting and Planning the Process of Forming Target-Program TPK's

	Preplanning Preparation and Planning						
		Long-Range		Medium Term	Current	Fulfillment of Plans for Building TPK	
Ministries and Departments	Forecasting TPK Master Chart	TPK General Project Plan	Program for Building TPK	5-Year Plan for Building TPK	Annual Plan for Building TPK	5-Year	Annual
1	2	3	4	5		6	
Commission of the USSR Council of Ministers for the major regional problem		Organizes drafting: appoints drafting organizations and defines assignments Resolves interdepartmental issues Conducts expert evaluation of the general project plan and program Prepares documents for approval of the general project plan and program		Checks correspondence of charts for development and draft versions of plans of ministries and departments to the general project plan and program of the TPK Resolve interdepartmental issues		Monitors the work of the general client Monitors the work of the general contractor Resolves interdepartmental issues	
USSR Gosplan	Discovers problems and priority TPK's Drafts the master chart of the country and identifies TPK's	Examines the TPK general project plan	Sets the principal parameters of the TPK and ceilings on resources Works out the principal indicators for the TPK and includes them in the main lines of economic and social development of the USSR	Includes the principal assignments for the TPK in the USSR plan Drafts the summary plan of capital construction for the TPK Examines and approves the principal indicators of economic and		Monitors fulfillment by ministries and departments of plans for scientific and project planning preparation, deliveries of equipment and	

Table (continued)

1	2	3	4	5	6
	Examines the TPK master plan		Examines the TPK program and sees that it is linked to the country's physical and financial resources	social development of the TPK and monitors their fulfillment Approves the ceilings on capital investments and construction and installation work, activation of fixed capital, production capacities, appropriations from the state budget and deliveries of material and technical resources necessary to building the facilities of the TPK Defines the assignment for the sector or industry (sectors or industries) in which the TPK is specializing	preparation for operation of the facilities of the TPK Monitors fulfillment of the principal indicators of economic and social development of the TPK
Gosplan of the union republic	Drafts the master chart of the TPK		Includes the principal indicators for the TPK in	Approves the plan of economic and social development of the kray	Monitors fulfillment of plans for the

Table (continued)

1	2	3	4	5	6
			the principal indicators of economic and social development of the republic	(oblast) in which TPK's are identified Includes in the plan of economic and social development of the republic the summary indicators for the TPK Monitors inclusion of the facilities of the TPK in the plans of departments under republic jurisdiction and approves them	building and operation of facilities of the TPK Monitors fulfillment of obligations of departments under republic jurisdiction arising out of plans for the TPK
USSR Gosstroy and gosstroy of the union republics	Drafts the area layout scheme	Prepares the general project plan of the TPK and area layout designs	Drafts measures to organize construction		Exercises the drafter's supervision over fulfillment of the area layout scheme and designs and the schemes for performance of construction

Table (continued)

1	2	3	4	5	6
Gosbank and USSR Stroybank				Drafts plans of appropriations and credit financing for construction of all facilities of the TPK in conformity with the master chart, general project plan, program, plan for construction and summary plan of capital construction of the TPK	Furnishes financing from the state budget and credit financing of project planning and contractor organizations Settles accounts between clients and contractor organizations and performs other banking operations
Other ministries and departments of the USSR and of the union republics	Draft charts of development of the sector or industry in which the facilities of the TPK are identified	Prepare project plans of the facilities of the sector or industry so as to take into account their location within the TPK	Draft measures and discover the need for resources necessary for the construction and operation of the facilities of the TPK	Draft the plan of the sector or industry in which the facilities of the TPK are identified Compile the list and itemize list of new construction and reconstruction projects of the sector or industry within the TPK	Allocate funds to build the facilities of the sector or industry Allocate funds for shared participation in building facilities common to the entire complex

Table (continued)

1	2	3	4	5	6
					Monitor construction of the facilities of the sector or industry and settle accounts with contractor organizations for facilities whose construction has been completed
				Draft plans of scientific research, project planning, makeup of equipment, personnel training, and solution of specific social problems for the facilities of the TPK	Organize the activity of operating facilities
					Take part in the work of local bodies for management of the TPK and separate industrial concentrations
General contractor--one of the USSR ministries		Drafts proposals for organization of the	Drafts measures to create the material and technical base of construction, to	Drafts the proposed plan of contract work for the TPK as a	Does construction work and turns the finished

Table (continued)

1	2	3	4	5	6
		process of construction in building the TPK	form construction organizations, to carry on the construction process, and to coordinate the work of subcontractor organizations, deliveries of equipment and building materials from outside the TPK	whole jointly with the general client Concludes contracts directly with the client in accordance with the plan of contract work Coordinates the plan for formation of the material and technical base of construction and construction organizations of the TPK	projects over to customers Creates the material and technical base of construction Monitors the work of subcontracting organizations Takes part in the work of local bodies for management of the TPK and industrial parks or concentrations
Kray (oblast) ispolkom of worker deputies, ASSR council of ministers	Takes part in drafting the TPK master chart Monitors the work and approves the area layout scheme of the TPK	Takes part in drafting the general project plan of the TPK Approves the area layout designs	Drafts the program for building the TPK and clears the intended measures with all departments involved in building the TPK Takes part in working out the principal indicators for the TPK	Drafts the plan of economic and social development of the kray (oblast) in which the TPK is identified, clears it with the republic gosplan (for TPK's in Siberia and the Far East the plan is also	Monitors fulfillment of plans of economic construction and plans of economic and social development by departments Monitors the activity of

Table (continued)

1	2	3	4	5	6
			for their inclusion in main lines of economic and social development of the USSR Discovers the need for all types of resources necessary to build the TPK as a whole Takes part in resolving interdepartmental issues	approved by USSR Gosplan) Compiles the list and itemized list of new construction and reconstruction projects of intersector significance for the TPK as a whole Takes part in drafting the summary plan of capital construction as a whole for the TPK Drafts the plan of contract work for the TPK as a whole with the status of the general client jointly with the general contractor Monitors observance of the master chart, the general plan and program for construction of the TPK by all	the general contractor Coordinates the activity of all departments involved in formation of the TPK at the local level Bears responsibility for fulfillment of the plan for building the TPK, especially for development of all elements of the infrastructure of the TPK Supervises the activity of local bodies for management of the TPK and separate industrial parks

Table (continued)

1	2	3	4	5	6
				ministries and departments participating in formation of the complex Drafts the plan for building the TPK Takes part in settling interdepartmental issues Performs the functions of the general client	Performs the functions of the general client

The annual plan for building the TPK is compiled on the basis of the program and the 5-year plan. It is mandatory that the final results correspond to the assignment of the 5-year plan. The place of the annual plan and procedure for its drafting and approval are analogous to those of the 5-year plan.[8]

All the proposed documents are related not only to one another, but also to the preplanning and planning documents which are drafted or, one can assume, will be drafted for units of administrative and geographic divisions where target-program TPK's are scheduled for formation--the kray (oblast, union republic, country) (see the diagram). A certain subordination (from top down) is preserved in the adoption of final decisions, and it is assumed that each of these documents can be adjusted on the basis of more detailed work done at the lower levels.

For example, it might prove advisable to return to the TPK master chart after revision of certain technical solutions in the process of drafting the general project plan of the TPK. Or it will be necessary to go back again to the general project plan of the TPK if in drafting the program of the TPK it has turned out that some technologies envisaged in the project plan cannot be mastered within the assumed period of time. It may be necessary to adjust the 5-year plan on the basis of the results of fulfillment of annual plans or because of changes in external situations for formation of the TPK. It is possible that the drafting of documents for individual TPK's will reveal the need for changes in certain sectoral and regional plans or in the long-range target program for solving the relevant problem.

We thus assume a rather complicated, but flexible process of preplanning preparation and planning of target-program TPK's, which, in our opinion, can be made consistent with the planning period (long-range, medium-term and annual) and phases of planning (conception, main lines, draft plan) adopted for the ASPR of USSR Gosplan.

We should note that after preparation of the Comprehensive Program of Scientific-Technical Progress, determination of the principal problems of the national economy over the next 20-25 years and preparation of the master chart of location of the productive forces of the USSR, the target programs for solving the major intersector regional problems will be drafted, and priority target-program TPK's will be forecast as a principal part of those programs. The principal forecasting document of the TPK will be the master chart of the complex, covering the future period of 20-25 years. When the main lines of economic and social development of the country are being drafted in the stage of conception, the master chart of the TPK is revised to cover the 10-15-year period, in the stage of main lines the general project plan and program of the TPK are drafted, and in the stage of the draft plan the consolidated indicators for target-program TPK's which will be included in the main lines of economic and social development of the USSR are worked out. Thus, the program for building the complex becomes an important preplanning document for each TPK, covering the period of 10-15 years, especially for new TPK's. In the regime of medium-term planning the master chart, general project plan and program of the TPK are analyzed and adjusted in the stage of main lines, and the 5-year plan of the target-program TPK is drafted from them in the stage of the draft plan. In the regime of annual planning the project plan and plan for building the TPK in the coming year are drafted on the basis of programs and the 5-year plan.[9]

The scheme we have presented has not gone through experimental verification and is set forth here as a preliminary conception. In our view the time has come for broad discussion of the theoretical and practical questions of including TPK's in the system of preplanning preparation and among entities being planned. There exist both the possibility and the need for this: the number of publications has been sufficiently large, and the draft version of the 11th Five-Year Plan is being prepared. The initial document for commencement of discussion might be the draft of procedural recommendations for planning regional industrial complexes prepared by TsENII [Central Scientific Research Institute of Economics] of RSFSR Gosplan so as to take into account the research results of IEiOPP SO AN SSSR, NIIE [Scientific Research Institute of Economics] of Azerbaijan Gosplan, and NIEPiN [Scientific Research and Experimental Institute of Planning and Standards] of Kazakh Gosplan.[10] Procedural recommendations presuppose subsequent drafting of the long-range target program for building the TPK, the general project plan for construction, the main lines of development and the 5-year and annual plans. "The program is designed to substantiate the goals of building the complex, to define its structure, the phases of its formation, possible volumes of production and the resources necessary for this purpose. The general project plan for construction is compiled in accordance with the program for building the complex in order to define its geographic organization. It substantiates location of industrial parks and individual enterprises, the facilities of the production and social infrastructure, and it resolves the questions of settlement and environmental protection. The main lines of the complex's development are worked out on the basis of the target program and the general project plan for its construction. In accordance with the needs of the national economy and the available resources they state the volumes of output over the planning period and also the sequence of construction and activation of principal production operations and the nonproductive facilities of the complex. Five-year and annual plans are responsible for practical realization of the main lines of development of the complex through detailed elaboration of assignments for production and construction, by correlating dates for activation of interrelated production operations, by determining sources from which to meet needs for various types of resources, and by designating those responsible for performance."[11]

We are convinced that support will be given to the preparation of the recommendations and to many of the principles. A discussion of them is not the subject of this article. But it is easy to note a certain difference in the names, sequence and content of the five basic preplanning and planning documents we have described and those proposed by the recommendations.

The names are different for the first (master chart and long-range target program) and the third (program for building and main lines of development) documents, and there are differences in the content of the programs and project plans, and so on.

It is our point of departure that creation of target-program TPK's is not an end in itself, but results from the need to solve a major regional problem. Use of this form of organization of the productive forces is one of the means of increasing the efficiency of a particular version for solving the entire problem. It seems to us that the long-range target program should be drafted for the problem as a whole, and the task of forming the TPK will be one of its elements (that would be the relationship, for example, between the problem of developing the petroleum and gas resources of the West Siberian Plain and the task of building the Middle Ob' TPK). Since the target program of the problem and the master chart of location of the productive forces of the USSR have already discovered the goals of building the specific TPK, the scale of development of the specialized sectors and industries and the need for the principal resources which are scarce, we have proposed the master chart as the first forecasting document for the TPK.

The program for building the TPK, as we see it, ought to be a concrete document--a guide used as the basis for shaping plans. The drafting of the program has accordingly been envisaged after the master chart and the general project plan of the TPK, when the spatial and production structures of the complex and the principal technical solutions are already known, that is, when it is possible to reveal the system of measures whose implementation is necessary to creation of the complex. The content of the general project plan of the TPK seems to be different in the recommendations, one gets the impression that this is simply another name for the area layout scheme. The documents and sequence of their preparation which are proposed in the recommendations would be easier to understand if the time frame for each of them had been indicated as well as their relation to the overall system of preplanning and planning documents, planning periods and phases of planning which have now been adopted for the ASPR of USSR Gosplan.

It seems to us advisable to discuss as well the forms which USSR Gosplan has recommended to ministries and departments for planning the TPK. At present they largely duplicate the plans of sectors and industries and krays (oblasts), they contain much report data for information purposes, but they do not contain enough of the indicators which are directly necessary for management of the very process of building the TPK both locally and at the center. They are oriented more toward planning operating complexes than toward the formation of new ones. Thus there is both a need and subject for discussion and there is material so that the discussion will be sufficiently specific.

It is obviously best to examine the problems of improving planning together with the problems of managing the process of building the TPK. Neither improvement of preplanning substantiation nor the drafting of plans in the present system for management of the formation of the TPK yet guarantees their unconditional fulfillment. The opinion that bodies for management of the TPK need to be set up can now be taken as generally established, and many specific proposals have been made.

At the present time certain aspects of forecasting and planning the process of forming the specific TPK are reflected in the plans of numerous ministries, departments, bodies for management of respective units of administrative and geographic entities. Many organizations are taking a direct part in the building of complexes. But, as experience has shown, this is still no guarantee, but on the contrary sometimes complicates transformation of formation of the TPK into a planned process of creating a system of interrelated economic elements, of solving social, environmental-protection and other problems in carrying out programs pertaining to various regional problems. It is not enough to have a mere itemized list of construction projects or even a summary plan of capital construction as the sum total of proposals of individual departments. One must have a unified plan for creation of the TPK as a whole, and its foundation will be the ultimate goal of forming the complex and coordinated ways of attaining it. One must have bodies of management that have been granted the respective powers and are responsible for fulfillment of the plan for building the TPK.

We can identify three large groups of problems in management of the process of forming the TPK:

1. Working out the fundamental directions for formation of the TPK, planning and monitoring the activity of all ministries and departments taking part in building the complex.

2. Drafting preplanning and planning documents, coordination of activities to build the facilities of the TPK and day-to-day management of the process of forming the complex as a whole.

3. The preplanning preparation and planning of the process of building the individual facilities of the TPK and day-to-day supervision of their operation.

In our opinion solving the problems of the third group does not necessitate setting up additional management entities and can be performed within the limits of the management system of ministries and departments (including not only ministries, but also supply, transportation, financial and other organizations). It is assumed that in charts of development of their sectors and industries ministries will identify the facilities of target-program TPK's. It is left to them to draft programs for scientific preparation and all the project plans and estimates for all projects and the list of measures whose performance is necessary to the construction and operation of the facilities of the sector or industry within specific target-program TPK's. In drafting 5-year and annual plans ministries include the facilities of TPK's in lists of construction projects and itemized lists of projects scheduled for construction and expansion, they take them into account in distributing ceilings of capital investments, ceilings of contract work and ceilings of scarce resources, in compiling orders for equipment and infrastructural services and in drawing up other planning documents.

These elaborations for the facilities of the TPK are indispensable not only to compiling plans of the respective ministries, but also to preparation of preplanning and planning documents for individual target-program complexes--programs for solving the major regional problems, master charts, the general project plan and programs for building TPK's, indicators for complexes to be included in main lines of economic and social development of the USSR, 5-year and annual plans of capital construction and plans for building TPK's.

In the period of building the facilities ministries monitor progress of construction or reconstruction through directorates of enterprises under construction or already in operation, they make preparations for the startup of enterprises and they manage facilities which are functional (both productive activity and also performance of plans for the social development of the work force). Ministries settle accounts with contractor and other organizations as the completed projects are delivered, and they take part in resolving intersector issues related to formation of the TPK both at the level of the country's Council of Ministers and also at the immediate local level. All interested departments also do preparatory work to build their own projects (including projects of sectors of all aspects of the infrastructure), they plan their development and they supervise the process of their operation. All the infrastructural sectors would bear full responsibility for supporting production and furnishing the inhabitants of the complex with their respective services.

The situation is different with solving the aspects of management referred to in the first and second groups. An analysis of material on formation of target-program TPK's shows that the present system of management does not guarantee responsive settlement of either basic or current problems, and as a consequence the planned flow of the progress of the TPK's formation is not guaranteed. The introduction of new documents and the organization of their orderly preparation, as envisaged by the July (1979) decree of the CPSU Central Committee and USSR Council of Ministers, will unquestionably relieve the problem of organizing the process of forming the TPK.

We share the widespread view that management entities at two levels to organize the planned formation of the TPK--at the center and within the actual kray (oblast, ASSR) where the complex is being created. This two-tier structure is determined by the makeup of the tasks and by the decisionmaking system that has taken shape.

The version for organization of the central agency for management of the process of creating target-program TPK's usually places it in USSR Gosplan.

It seems more sensible to us to create that agency right within the USSR Council of Ministers.[12] The experience of the Commission for the BAM and creation of the Commission for Problems of the Fuel and Energy Complex provide grounds for supposing that commissions of this kind are indispensable for the other largest problems of the national economy, including certain regional problems. Thus the problems of forming each target-program TPK as an integral part of certain regional problems would fall in the sphere of activity of one of the commissions of the USSR Council of Ministers.

In our opinion the commission for problems of the TPK might perform the following: a) coordination of the activity of USSR Gosplan, the USSR Academy of Sciences, councils of ministers of union republics and USSR ministries and departments in drafting the long-range target program for solving the major regional problem as a whole, including the problems of spatial organization of the productive forces through formation of the TPK; b) assignment of basic responsibilities (general project planner, general client, general contractor) and drafting assignments, conduct of expert state evaluation and preparation of documents for approval of the general project plan and program for building the TPK; c) monitor correspondence of charts of development and drafts of 5-year and annual plans of ministries and departments with the general project plan and program for building the TPK; d) settlement of interdepartmental issues; e) monitoring the work of the general client and general contractor of the TPK.

As we see from this list, the commission of the USSR Council of Ministers would perform the function of a coordinator and monitor and would figure as one level where interdepartmental disputes arising at the level of USSR ministries and departments would be taken up. In the process of its work the commission would establish its own direct communications with the local entity for management of the TPK through its authorized representative, who would himself be in the area where the program for solving the respective major regional problem is being carried out.

As for the local entity for management of the process of formation of the TPK, many proposals have already been made in the scientific literature and periodicals. No one has any doubt that such an entity is needed. The discussion concerns what it should be, what functions it should perform and what means it should use. The view that has become most widespread is that we need a body reminiscent of the Bratskgesstroy [Agency for Management of Construction of the Bratskaya GES] or an interdepartmental organization headed by an authorized representative of USSR Gosplan or the USSR Council of Ministers. In both cases the management entity would be located at the center of the TPK.

Unfortunately, we do not have sufficient basis for unconditional support or rejection of the versions which have been proposed, and they need serious study. But in our opinion they are not the best ones. Even though Bratskgesstroy played an exceptionally important and unquestionably constructive role in the process of building the Bratsk--Ust'-Ilimsk TPK, we do not feel that a construction organization can be regarded as a body for management of a TPK and should be concerned with all economic matters (as Bratskgesstroy was forced to do). And we hardly need a specialized interdepartmental entity, since its senior official, be he even at the rank of an authorized representative of USSR Gosplan or USSR Council of Ministers, would be compelled to settle all fundamental interdepartmental issues at the center.

It has often been proposed that a specific organization--a management for construction of the TPK--be set up as the local body for management of the TPK. This proposal has in our opinion two shortcomings:

1. Management of the construction process is a very important question, but it is by no means the only question whose settlement should be the concern of the local body for management of the process of the formation (and not just the construction) of the TPK. To refer to the body as a construction administration would from the outset diminish its sphere of activity. Yet experience shows that the success of construction is largely determined by timely solution of many other organizational questions which the agencies responsible for supervising the process of construction are compelled to concern themselves with, though they are not required to do so.

2. It is doubtful that it would be wise to divide responsibilities for the process of building the facilities of the TPK between the proposed construction administration and the general contractor. It seems to us that it is more important to broaden the rights and duties of the general contractor and to make that entity responsible for organizing construction as a whole (including the activity of subcontractor organizations) and for fulfillment of the capital construction plan. Particularly specialized construction operations (main pipelines and rail lines, power transmission lines, etc.), whose coordination would remain the responsibility of the kray (oblast) ispolkom or ASSR council of ministers, constitute an exception.

It seems to us that if commissions of the USSR Council of Ministers are created for the largest regional problems, the respective kray (oblast) soviets of people's deputies or ASSR councils of ministers should become the principal organization bearing responsibility for creation of target-program TPK's. This is also important because as a rule all or a substantial portion of the major regional problem will be dealt within the boundaries of that kray (oblast, ASSR).

Kray (oblast) ispolkoms and ASSR councils of ministers should take part in drafting the target program for solving the major regional problem as a whole and in preparing all preplanning and planning documents for the TPK, should coordinate at the local level the efforts of all departments involved in creating the TPK, should settle within its competency interdepartmental disputes and should take part in the settlement of intersector issues at all levels. The kray (oblast) ispolkom or the ASSR council of ministers should in our opinion perform the role of the general developer (zastroyshchik) of the TPK, should monitor departmental fulfillment of plans for capital construction and economic and social development, should monitor the activity of the general contractor and subcontracting organizations, and should bear responsibility for fulfillment of the plan for construction of the TPK, especially for development of all elements of the complex's infrastructure.[13]

In his address at the 25th CPSU Congress A. N. Kosygin emphasized: "It is very important that local Soviet bodies and councils of ministers of union republics play an active creative role in building regional industrial complexes. Effective supervision of the construction of production enterprises as well as of housing, utility and cultural facilities, schools and hospitals, of their timely and synchronized activation, and of the training of qualified specialists in the most common occupations--all of this depends in large part on the activity of Soviet bodies."[14]

The participation of the kray (oblast) ispolkom or ASSR council of ministers in preparation of preplanning and planning documents for the TPK and in management of the process of its formation can be represented as follows:

a) in the forecasting frame (20-25 years) it would take part in drafting the long-range target program for solving the major regional problem as a whole and the master chart of the particular TPK, would coordinate work on the complex's area layout scheme and would approve it;

b) in the long-range planning frame (10 years) it would take part in drafting the general project plan of the TPK and working out the principal indicators for the TPK to be included in main lines of economic and social development of the USSR, would draft the program for building the TPK and would ascertain the requirement for scarce resources necessary to carry out the program for construction of the TPK;

c) in the frames of 5-year and annual planning it would draft the plan of economic and social development of the kray (oblast, ASSR) in which the TPK's are identified, the list and itemized list of new construction and reconstruction projects of intersector facilities for the TPK as a whole, and the plan of contracting work for the TPK, would take part in compiling the summary plan of capital construction for the complex, and would monitor adherence to the master chart, general project plan and program of the TPK in the drafting of plans by all ministries and departments participating in building the complex.

In doing this work the kray (oblast) ispolkom or ASSR council of ministers would call upon its own divisions and other subordinate organizations and would create a subdivision (with the status of a division) right at the center of the TPK being built.[15] Because the plan would presumably be the principal document regulating the process of the TPK's formation, this subdivision would probably be referred to as a planning commission or management for creation of the TPK. The following might become the main lines of activity of the TPK commission: a) participation in preplanning studies and the drafting of preplanning and planning documents for the TPK; b) monitoring and coordination of the efforts of building the specialized facilities and production operations rounding out the complex; c) supervision of formation of the entire infrastructure in all its aspects; d) creation of the initial data bank.

The TPK planning commission should be subordinate to one of the deputies of the kray (oblast) ispolkom or the ASSR council of ministers, and in the process of work would have close ties not only with the divisions of the kray (oblast) ispolkom or the ASSR council of ministers, above all with the planning commission of the kray (oblast, ASSR), but also with the respective commission of the USSR Council of Ministers. Only direct communication between the bodies for management of the TPK at the two levels--the commission of the USSR Council of Ministers (upper level) and the planning commission or administration for creation of the TPK of the kray (oblast) ispolkom or the ASSR council of ministers--the lower level--can guarantee responsive settlement of issues both in drafting and in carrying out plans for creation of the complexes.

The life of the powers of the bodies for management of the TPK (the commission of the USSR Council of Ministers and the TPK planning commission) is determined by the period for solving the respective problem or by the period of its exceptional importance to the national economy. As a rule for the TPK planning commission it would correspond to the time from commencement of formation of the TPK to the complex's passage into the phase of permanent operation. Neither the commission of the USSR Council of Ministers nor the TPK planning commission should replace either regional or sectoral management entities which are functioning within the krays (oblasts, ASSR's). The jurisdiction and powers of bodies for management of the TPK are restricted and associated only to problems in day-to-day supervision of the drafting and performance of preplanning documents and plans for creating the TPK. On all other matters of administration (education, health, trade, etc.) the region covered by the complex falls in the jurisdiction of other divisions of the kray (oblast) ispolkom or ASSR council of ministers or ministries and departments.

For example, when state plans of economic and social development of krays (oblasts, ASSR's), cities and rayons, as well as of ministries and departments are being drafted, the areas of the TPK, its facilities and its population are included in them. Facilities of the TPK which have been delivered for operation, including facilities of the infrastructure, should not remain under the jurisdiction of the head construction organization or head client. Otherwise, as shown by the experience of Bratskgesstroy, the specialized construction organization is compelled to perform general economic functions. Up to now Bratskgesstroy has been involved in the problems of operating a large portion of the housing stock of Bratsk, organizing passenger and freight transportation, trade, the food service industry and even the production of many types of foodstuffs at industrial enterprises.[16]

But as a rule the departments that should be involved with them are in no hurry to set up their own subdivisions, especially in areas just being developed for the first time.[17]

Agencies of soviets of people's deputies should perform their full scope of functions in the area occupied by the TPK from the very commencement of formation of the complex. The city is just as complex a system as the enterprise, and its future destiny, the living conditions of the population and conditions under which facilities in the production sphere operate depend in large part on how it begins to take shape. But at present the management of the enterprise under construction is set up from the very outset of construction of large production facilities, but there is no "directorate" of the future city. The gorispolkom makes its appearance much later, when many shortcomings in the shaping of the city are already difficult to correct and the key positions (housing stock and many services) have already become concentrated in the hands of the individual departments (enterprises).

Assuming the functions of the central and local bodies for management of the TPK we have noted above and enhancement of the role of the 5-year plan as a principal form for planning economic and social development and the basis of economic activity, and when the new system of planning and organization of capital construction is introduced, the role of gosplan, gosstroy, gosbank, USSR Stroybank, councils of ministers and gosplans of union republics in the process of creating the TPK will not only be preserved, but will in fact be enhanced.

The principal effort to plan target-program TPK's is concentrated in USSR Gosplan, beginning with analysis of the comprehensive program of scientific-technical progress, to discover the principal regional problems and priority TPK's, and ending with monitoring the fulfillment of 5-year and annual summary plans of capital construction and the principal indicators of the complex's economic and social development. This effort might be distributed as follows in accordance with the planning frames adopted in USSR Gosplan:

a) in the forecasting frame (20-25 years)--drafting the master chart of location of the country's productive forces and identification of priority target-program TPK's, examination of the target program for solution of the major regional problem and recommendations for formation of the TPK, and examination of the master chart of the specific complex;

b) in the long-range planning frame (10-15 years)--examination of the general project plan of the TPK, determination of the basic parameters of the TPK and ceilings on resources necessary to create the complex; examination of the program for building the TPK and its linkage to the country's physical and financial resources; drafting the principal indicators for the TPK for inclusion in the main lines of economic and social development of the USSR;

c) in the 5-year and annual planning frame--determination of assignments for the specialized sector (sectors) and inclusion of the principal assignments for the TPK in the State Plan of the USSR's Economic and Social Development; examination and approval of the principal indicators of the TPK's economic and social development and monitoring their fulfillment; approval of the list and itemized list of enterprises and installations scheduled for new construction, expansion and reconstruction, monitoring inclusion of the facilities of the TPK in plans of ministries and departments, dates scheduled for activation of fixed capital and production capacities, the assurance of the ceilings on capital investments and contracting work, appropriations from the state budget and delivery of material and technical resources; drafting the summary plan of capital construction of the TPK.

The role of USSR Gosstroy, gosstroys of the republics and their institutes in forming the TPK is growing considerably. Whereas up to now their participation has been restricted to drafting regional layout schemes and plans, master charts and project plans of cities, and project plans of industrial parks, now their duties will also include the drafting of the general project plan of the TPK and the list of measures whose performance is necessary to fulfillment of the capital investment portion of the program for building the TPK. Gosstroy organizations should have broader rights of designer's supervision over adherence to the general project plan, area layout schemes and other project planning documents related to the use and infrastructural development of the area, to human settlement and to environmental protection.

In accordance with changes in the procedure for financing capital construction outlined by the July (1979) decree of the CPSU Central Committee and USSR Council of Ministers, the functions of organizations of the Ministry of Finance are being altered somewhat, and new ones are being envisaged. Departments and offices of USSR Gosbank and USSR Stroybank will have 5-year and annual plans of appropriations from the state budget and credit financing from funds set aside by clients, which are to be squared with the plan for building the TPK, the summary plan of capital construction and the plans of economic and social development of the kray (oblast, ASSR). The financing of all operations to build the facilities of the TPK, settlement with project planning organizations for completed projects and settlement of clients with contractor organizations for projects on which construction has been completed and which have been prepared for the manufacture of products or the rendering of services, as well as other banking operations will be conducted in accordance with the plan.

The general contractor's role is also undergoing a substantial growth. Usually the general contractor is one of the construction ministries whose configuration is relevant to the specialized industries of the future TPK and which heads or is ready to build a subdivision of the necessary capacity within the area of the complex. It is possible that for areas of intensive economic development involving a large scale of civil engineering as well as industrial construction, where development of the productive forces is not restricted (in either time or space) solely to building the target-program TPK, it would be advisable to have large regional construction organizations of general construction ministries (like the USSR Ministry of Construction recently created in the regions of the Far East and Transbaykalia). These construction organizations might assume the role of general contractor in building the TPK.

It is very important that the general contractor be appointed simultaneously with the taking of the decision to create the TPK, work in close contact with the general client, act as intermediary and coordinate the work of subcontractor organizations, take part in drafting the preplanning documents and plans for building the TPK and bear full responsibility for timely construction of all the facilities of the complex.

In the stage of preplanning preparation and the frame of long-range planning (10-15 years) the general contractor drafts for the general project plan a set of proposals for organization of construction. In shaping the program for building the TPK the general contractor prepares proposals for creation of the material and technical base of construction, for the formation of construction organizations, for deliveries of building materials and other types of material and technical supply from outside the boundaries of the complex. In the stage of preparing 5-year and annual plans the general contractor drafts the proposed version of the plan of contract work for the TPK as a whole jointly with the general client, concludes contracts directly with clients in accordance with the plan of contract work, coordinates plans for formation of the material and technical base of construction and construction organizations of the TPK. And finally, in the period of carrying out the plans, the general contractor does construction work and delivers to clients finished projects, develops the material and technical base of construction, monitors the work of subcontractor organizations, and takes part in settling intersector disputes.

The discussion of problems in planning and managing the TPK can be especially fruitful now, after adoption in July 1979 of the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality."[18] Along with other fundamental aspects of improving management of the economy, it paid considerable attention to the TPK. Certain specific preplanning and planning documents of the TPK were mentioned for the first time, the TPK was given its place in the main lines of the country's economic and social development and 5-year and annual plans, and specific orders to solve certain problems in formation of the TPK were issued to USSR Gosplan, the councils of ministers of union republics, to ministries and departments and to local soviets of people's deputies. We can thus take the position that the issue of identifying the TPK as an independent entity has in principle been resolved.

For TPK's of Siberia and the Far East the decree called for the drafting of a larger number of documents than for complexes of other regions. However, judging by what has been written in the press, the problems of forming the South Tadzhik Complex in Central Asia and the Pavlodar--Ekibastuz Complex in Kazakhstan and others are equally complicated. Perhaps we should not be identifying the areas where the complexes are being built, but should be determining more clearly the restricted number of priority TPK's and adopting a uniform system of preplanning paration, planning and management for all complexes of a given type. The need has arisen for the drafting of a summary document--the model plan for building the TPK. It is not yet known whether it would replace the proposed summary plan of capital construction, since its content is not yet clear. Thus there is still a great deal of work yet to be done relying on the July (1979) decree and employing the spadework of scientific organizations and the practical experience of project planning institutes, planning agencies and kray (oblast) soviets of people's deputies in order to create a straightforward and flexible system of preplanning studies and a system for planning and managing the process of forming the TPK. There is the task of stating precisely the composition and contents of documents, the task of preparing methods of drafting them, the task of defining the procedure for their approval and the task of monitoring their fulfillment.

Solving all these problems will unquestionably contribute to improving the country's planning and raising its economic efficiency. The importance of these problems was emphasized more than once at the 25th CPSU Congress. In particular, A. N. Kosygin, presenting an address on the tasks of the 10th Five-Year Plan, said that the creation of regional industrial complexes "... requires strict coordination of the efforts of ministries, supply agencies, project planning and construction organizations and supplier plants.... In the very near future we must work out the respective organizational forms for coordinating the efforts of carrying out the major programs and developing the complexes."[19]

FOOTNOTES

1. On our conception of target-program TPK's and their relations to the decision on the particular type and rank of regional problems, see: Bandman, M. K., "Target-Program Regional Industrial Complexes (Definition, Specific Features, Makeup, Boundaries and Content of the Tasks of Optimalizing the Process of Formation)," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 3), No 11, 1978, pp 32-79; Bandman, M. K., "Forecasting the Regional Industrial System of a Region in the Context of Target-Program Planning," in the book: "Opyt regional'nogo prognozirovaniya" [Experience in Regional Forecasting], Novosibirsk, 1977, pp 69-83.

2. Bandman, M. K., and Malinovskaya, M. A., "The Sayan Regional Industrial Complex," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 2), No 6, 1979, pp 9-14.

3. PLANOVOYE KHOZYAYSTVO, No 9, 1979, pp 5-36.

4. This makeup of the preplanning documents, proposed by IEiOPP SO AN SSSR, was discussed at a conference held 10-14 May 1977 in the settlement Listvyanka, Irkutskaya Oblast. Thereafter it was presented in the following publications with a certain differentiation of the makeup and substantiation: Gukov, V. P., Bandman, M. K., Kazanskiy, N. N., and Kibal'chich, O. A., "Problems of Preplanning Studies and Planning Formation of Regional Industrial Complexes," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 1), No 1, 1978, pp 3-11; Bandman, M. K., and Gukov, V. P., "Aspects of Improving Planning and Management of the Formation of TPK's," in the book: "Voprosy formirovaniya Bratsko-Ust'-Ilimskogo TPK" [Problems in Forming the Bratsk--Ust'-Ilimsk TPK], Novosibirsk, 1977, pp 126-139; Kibal'chich, O. A., "Regional Industrial Complexes of the USSR (Study, Planning, Approaches and Evaluation of Economic Benefit, and Management)," in the book: "Sovremennyye problemy ekonomicheskoy geografii" [Contemporary Problems of Economic Geography], Moscow, 1977, pp 3-19; Bandman, M. K., "Target-Program Regional Industrial Complexes (Definition, Specific Features, Composition, Boundaries and Content of the Task of Optimalizing the Process of Formation)," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 3), No 11, 1978, pp 32-39.

5. Proposals have been made for setting up regional institutes for regional planning and area layout in large regions, assigning them the functions of general project planner. See Aganbegyan, A. G., "Geographic Area and Sectors," PRAVDA, 7 December 1979.

6. PLANOVOYE KHOZYAYSTVO, No 9, 1979, p 18.

7. If specific programs of comprehensive development are being drafted for the economic regions and krays (oblasts, ASSR's) within which target-program TPK's are being formed, as is the case at present for the Far East, Eastern Siberia, Krasnoyarskiy Kray, and Tyumenskaya Oblast, then these programs and programs for building the TPK's must be consistent with one another (see the chart).

8. During the discussion of this paper in the stage of preparation other points of view were expressed concerning the makeup, names and drafters of particular documents for forecasting and preplanning preparation of the TPK. Sometimes the objections resulted from a different understanding of terms, a different name of particular documents, and differences in their place in the overall system of planning. It seems to us that at present there is no sufficient foundation for unconditional rejection or adoption of any particular proposal, since the criterion for either must be experience, and there is not yet enough of that.

9. One of the possible versions for the actual organization of the preparation of preplanning and planning documents for the TPK. "Metodicheskiye rekomendatsii po planirovaniyu territorial'no-proizvodstvennykh kompleksov (ovnovnyye polozheniya)" [Recommendations on Methods of Planning Regional Industrial Complexes (Basic Principles)], Moscow, TsENII of RSFSR Gosplan, 1979, Section 4, pp 17-22.

10. "Metodicheskiye rekomendatsii ...," p 44.

11. "Metodicheskiye rekomendatsii ...," Subparagraphs 2 and 6, pp 6-7.

12. A similar point of view has been expressed by A. G. Aganbegyan with reference to the experience of government commissions for the problems of the Urals--Kuznetsk Complex and the BAM. (Aganbegyan, A. G., "On Combination of the Sectoral and Regional Principles of Management of the Economy," in the book: "Geograficheskiye aspekty upravleniya" [Geographical Aspects of Management], Moscow, Mysl', 1978, pp 12-25) A proposal has been made to form a committee, council or commission for programs associated with the USSR Council of Ministers. (Shamov, A. A., "Improvement of the Regional Planning of Production," in the same book, pp 100-111)

13. More attention should be paid and thorough study needs to be devoted to the proposal of A. N. Semenov to the effect that "the building of the TPK should be financed from a single source on the basis of a project plan of the TPK that has been approved by the government and that is binding on all ministries and departments involved in it. On matters of allocation of funds to build the TPK the body for management of the TPK must deal with USSR Gosplan, but in no case with individual ministries. When an enterprise is put into operation, cost-accounting relations should be established between it and the body for management of the TPK to cover the operating costs and the development of the infrastructure." (Semenov, A. N., "Experience and Problems in Management of Comprehensive Development of a TPK," in the book: "Upravleniye realizatsiyey programm" [Management of Program Fulfillment], Moscow, 1977, pp 254-262) This proposal is particularly relevant at the present time, since it is in harmony with the principles of the July (1979) decree of the CPSU Central Committee and USSR Council of Ministers.

14. Kosygin, A. N., "Osnovnyye napravleniya razvitiya narodnogo khozyaystva SSSR na 1976-1980 gody" [Main Lines of Development of the USSR National Economy in the Period 1976-1980], Moscow, Politizdat, 1976, p 57.

15. In our opinion the council of directors cannot be looked upon as the principal local entity for management of the TPK either. Experience in the activity of the Council of Directors in Bratsk has been highly praised and offers grounds for dissemination of the experience of the

people of Bratsk (see "Bratsk--Capital of a TPK," EKO, No 5, 1979, pp 48-58). But we can hardly regard the council of directors as a local management entity. It was and should remain a voluntary representative body with an advisory right to vote in deciding on day-to-day organizational issues. The right to make the final decision should remain with the relevant subdivision of the kray (oblast) ispolkom or ASSR council of ministers, whose activity will be closely bound up with the fully authorized commission of the USSR Council of Ministers for the specific regional problem.

16. The chart of the organizational structure of Bratskgesstroy was given by V. P. Gukov in the book: "Voprosy formirovaniya Bratsko-Ust'-Ilimskogo TPK," Novosibirsk, 1977, p 134. He has also noted the principal conditions for formation and functioning of the infrastructure in the process of building the TPK. See Gukov, V. P., "Problems of Creating a Unified Structure of a Regional Industrial Complex," in the book: "Metodologicheskiye voprosy regional'noy ekonomiki" [Methodological Problems of Regional Economics], Novosibirsk, 1979, pp 90-103.

17. A similar situation obviously came about in the Middle Ob' TPK as well, where Glavtyumen'neftegaz [Main Administration for Petroleum and Gas for Tyumenskaya Oblast of the USSR Ministry of Petroleum Industry] was compelled to take over construction operations, worker supply (in which more workers and employees were employed than in the actual production of petroleum), equipment repair, motor pool and a part of the river fleet, subsidiary agricultural enterprises, plants for reconstituting powdered milk, housing management and municipal services and utilities, health institutions and much else (see Varlamov, V. S., "Problems of Planning and Managing the Processes of Forming Regional Industrial Complexes," in the book: "Geograficheskiye aspekty upravleniya," Moscow, Mysl', 1978, pp 119-130).

18. PLANOVOYE KHOZYAYSTVO, No 9, 1979, pp 5-36.

19. Kosygin, A. N., op. cit., pp 56-57.

THE TPK AS A SUBJECT OF THE COMPUTERIZED SYSTEM OF PLANNING COMPUTATIONS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 59-65

[Paper by M. Yu. Cherevikina]

[Text] One of the tasks confronting the study of the TPK as the subject of planning is its inclusion in the ASPR [computerized system of planning computations). Since formation of the target-program TPK takes place within the framework of the effort to resolve a major regional problem, their planning ought to have the characteristic features of the program approach to planning.

First, the participation of the TPK in realizing the ultimate goals of the regional program presupposes that the location of all elements of the economy, their internal and external relations, and the system of settlement will be reflected in planning indicators. The basic target indicators of the TPK plan are assignments for output of the specialized industries, ceilings for resources of the national economy, and the living conditions of the population.

Second, the TPK plan regulates the process of realizing those goals, i.e., the process of capital construction in the broad sense (including project planning). The following are represented in specific sections of the TPK plan: a) the volume of project planning and surveying work, the organizations assigned to do them, and project plans and estimates; b) ceilings of capital investments and the technological, sectoral and regional structure of their distribution; c) capital construction (volumes of construction and installation work, activation of capacities and projects, distribution of work items among contractors and the schedule for conduct of operations); d) facilities of the infrastructure of the entire complex (capacities, sequence of their activation, and volumes of services to be rendered).

Third, the plan reflects the resources (physical and labor) to be furnished to the TPK, the needs for them having been determined on the basis of the ultimate goals of forming the TPK and independently of the departmental subordination of the facilities. The compilation of planned balances of the most important types of raw materials, supplies and equipment are provided for accordingly. Calculation of the need for labor resources and planning measures to attract personnel presuppose regulation of migrational processes, specifically by working out a number of indicators of the standard of living of the population.

Optimum utilization of natural resources and environmental protection are most important indicators in the TPK plan. The TPK plan includes allowances for discharge of pollutants into the environment, which are set forth on the basis of the specific regional conditions and the planned combination of production operations; capital investments in treatment installations and environmental protection measures which are outlined so as to take into account the needs of the entire complex and not just the principal production operation alone.

At the levels of the ASPR of USSR Gosplan and the ASPR of gosplans of republics and oblasts regional planning is represented by a summary functional subsystem referred to as "Regional Planning and Location of the Productive Forces" (Regional Plan). At the upper level of the subsystem (ASPR of USSR Gosplan) the regional breakdown of sectoral plans and plans for the economies subordinate to councils of ministers of union republics is worked out, and the intended location of the productive forces is consequently reflected. The subsystem includes the bloc of the summary regional plan for development of the economies subordinate to councils of ministers of union republics and a bloc for location of the productive forces. In the ASPR of gosplans of union republics the subsystem "Regional Plan" is intended to substantiate the location of the productive forces within the republic and formation of the regional breakdown of the national economic plan. The subsystem consists of two blocs: a) the bloc of comprehensive development of the national economy of the republic's oblasts, rayons and cities; b) the bloc of location and regional organization of the productive forces.

At the present time the breakdown of the plan by programs is taken up within the sectoral and regional sections of the plan. In the sectoral and regional subsystems of the ASPR functions are identified for planning programs of various kinds. Among these functions at the level of the regional subsystem of the ASPR of USSR Gosplan the drafting of socioeconomic programs for various regional production combinations, including regional industrial complexes, is organized. Formation of TPK's is taken up in performance of the function of improving the regional organization of production.

Since the TPK has become a subject of planning, in our opinion there is a need to supplement the organizational structure of the ASPR. We propose that in the makeup of the subsystem "Regional Plan" at the level of the ASPR of USSR Gosplan there be a bloc for formation of target-program TPK's, whose function would be the drafting of multiannual, medium-term and annual plans for building TPK's within the framework of a comprehensive regional program.

The functioning of the TPK bloc in the ASPR should be aimed at ensuring unity in the planning of all projects included in the TPK thanks to the use of the target-program method (examination of formation of target-program TPK's in the framework of drafting the comprehensive regional program); the development and use of mathematical-economic models; the use of the balances "taken" from mathematical-economic models for computations of needs for resources; development of the functional structure for planning the TPK and distinct division of functions among structural elements of planning in the ASPR. The structure of the target-program TPK bloc is determined by the goals (tasks) of the TPK plan, by the bloc's place in the overall system of the ASPR, and by the bloc's connections in the subsystem.

In accordance with the goals of the plan for formation of the TPK the functional structure of the bloc should ensure the drafting of the capital construction plan, substantiation of program indicators and goal-directed distribution of resources. Since the target-program TPK bloc is part of the subsystem "Regional Plan" of the ASPR of USSR Gosplan, reflecting the process of planning the regional system of production, in which production tasks play the leading role, the structure of the TPK bloc should in our view synthesize the structures of sectoral subsystems and the ASPR of the republic (oblast). The following subblocs are identified for purposes of drafting the plan for formation of target-program TPK's, for interrelated solution of internal problems and to obtain communication between the TPK bloc and the subsystem "Regional Plan" and with other subsystems of the ASPR within the target-program TPK bloc: the summary subbloc, the subbloc of project planning and surveying work (PIR), the subbloc of capital investments, the subbloc of goal-directed facilities of the TPK, the subbloc of construction capability, the subbloc of the production infrastructure, the subbloc of physical balances, the subbloc of the social-residential infrastructure, the subbloc of optimum natural conservation and environmental protection, the labor and personnel subbloc, and the subbloc of methods support and improvement of management.

The summary subbloc is intended for fulfillment of tasks of two types: calculation of summary economic indicators and ensuring unity in drafting the plan both within the bloc and also taking into account the external relations. With the major regional programs and priority TPK's identified in the subsystem "Regional Plan" as the point of departure, the feasibility of forming the TPK is examined in the summary subbloc, and prior determinations are made of economic and social reference indicators for formation of the TPK that correspond to realization of the ultimate goals of the regional program. The reference indicators are sent to all the subblocs.

The work of compiling all project plans and estimates, from charts of development and location to the TPK master project plan, is coordinated in the PIR subbloc. In this subbloc the unified plan of project planning and surveying work for the TPK "project" is compiled, capacities of project planning organizations doing work for the TPK are planned, and they are brought into line with the respective sectoral subsystems. A considerable number of the functions of coordinating plans are determined by the specific nature of the TPK as the entity being planned. The facilities included in the TPK have differing departmental subordination; the resources on which formation of the complex is based are multipurpose in nature, and therefore interlinkage of parameters of the development of the individual elements and reconciliation of the various aspects of the plan and of the plans of different departments are an important task in the process of planning the TPK.

The functions of linkage of plans for one of the determining types of resources--capital investments--in the form of a balance are performed in the subbloc of capital investments. In this subbloc adjustments are made in the amounts of resources set forth in the regional program, in their distribution among the facilities of the complex, in their technological structure, in their regional structure, and in indicators of activation of capacities. Aside from the working out of indicators reflecting the need for and distribution of capital investments, measures ensuring compilation and fulfillment of the capital investment plan are worked out in this subbloc. The indicators are computed on the basis of project plans and estimates, whose characteristics come from the PIR subbloc, on the basis of the need for the ultimate product which is stated as the goal of the TPK. The calculated indicators are compared to the reference figures, and any possible change of the latter is substantiated. The information is then sent to the summary subbloc.

The subbloc of goal-directed facilities of the TPK is intended for analysis of the proposals of ministries and departments and for their adjustment on the basis of computation of the resources needed by the sectors and industries representing specialization. It is here that revisions are made in proposals for development of the sectors and industries representing the TPK's specialization and in their principal indicators (activation of capacities, capital investment ceilings, and the need for personnel, principal forms of raw materials, supplies and equipment). The preliminary indicators are formed on the basis of the proposals of sectors and industries, they are sent to the summary subbloc for reconciliation with possible parameters of development of other elements of the TPK, and they are then cleared with the sectoral subsystems.

The subbloc of construction capability is made separate from the subbloc of the production infrastructure because of the important role the indicators of the capital construction plan have for the TPK. In it a comparison is made of indicators of activation of capacities and construction capabilities, and measures are outlined to develop the construction capability. Planning indicators are calculated on the basis of project plans and estimates, and a possible adjustment of reference figures sent to the summary subbloc is substantiated.

In the subbloc of the production infrastructure functions are performed to compile the plan for three types of infrastructure: transportation, heat supply and power supply. Analysis of the development and location of the facilities of the infrastructure is provided for as a planned function. The following types of indicators are computed in the subbloc: activation of capacities; fixed productive capital by types; capital investment ceilings ensuring the necessary growth of capacities; the need for personnel; the need for principal types of raw materials, supplies and equipment. Balances that make it possible to calculate the additional needs and necessary growth of capacities more soundly are compiled for the branches of transportation, for power supply and for heat supply.

The planning of the production infrastructure is oriented toward creation of the facilities common to the entire complex outside the departmental frameworks. Opportunities for formation of the complexwide infrastructure and for centralizing facilities (the complexwide motor pool, a single TETs, and so on) need to be discovered in an analysis of project plans and estimates. This centralization of the infrastructure presupposes changes in present procedure for planning and financing projects. The subbloc of methods support and improvement of the organizational structure of management has been envisaged to solve problems of this kind.

The subbloc of physical balances is intended for compilation of balances for the most important types of raw materials, supplies and equipment so as to determine the complex's needs and possible sources from which to meet those needs. An important function of the subbloc is to reconcile the TPK's requirement with the respective summary resource-balance subsystems of the ASPR and with the statement of that need in the plan of suppliers. In this same subbloc provision is made for the possibility of organizing a centralized system of deliveries, for drafting measures that ensure centralized material and technical supply and for computation of the indicators of activation of storage capacities (area), capital investments and the need for personnel.

The subbloc of the social-residential infrastructure is intended for working out the principal indicators of its development and for determining the necessary resources and measures to guarantee that development. The planning of the social-residential infrastructure relies on project plans and estimates, and one of the functions performed in the subbloc is analysis of project plans and estimates related to development of the facilities of the social-residential infrastructure and comparison of the capital investments for its development on the basis of the proposals of the ministries and according to the TPK general project plan. In view of the importance of the social-residential infrastructure to formation of the TPK and to fulfillment of the program and taking into account as well the substantial regional differentiation of living conditions of the population that is possible, it is indispensable in this subbloc to provide the function of examining standards for the supply of the services of the social-residential infrastructure and to prepare proposals for possible changes in them. It is here that measures are worked out that ensure the comprehensive character of development of the social-residential infrastructure in accordance with standards that reflect the peculiarities of the particular region and the regional program.

A peculiarity of this subbloc is the close association of the functions it performs with the ASPR of the republic and oblast. Among them are reconciliation of the main lines of social development of the TPK with the main lines of social development of the republic and oblast, and checking their identification in the relevant sections of plans.

The indicators--activation of capacities of the social-residential infrastructure, capital investment ceilings, the need for personnel and the need for principal types of raw materials, supplies and equipment (to carry on construction)--are sent to the summary bloc for correlation.

The labor and personnel subbloc is intended for performance of three types of functions: 1) calculation of the TPK's need for labor resources and compilation of the balance of labor resources; 2) drafting of measures for personnel training and correlation of the plan of capital construction of educational institutions with the respective sectoral subsystems of the ASPR of USSR Gosplan and the ASPR of the republic, oblast; 3) drafting of measures to attract and hold personnel. The functions of analyzing, revising and drafting norms and standards governing the standard of living of the population are distinguished among these measures. This pertains to the set of standards of personal money income. The existence of differing payment and differing supplements for one and the same occupation in different production operations of the TPK creates the basis for internal migration. Standards pertaining to the supply of housing, consumer goods, and the services of the social-residential infrastructure should undergo analysis and possible changes. These standards are cleared with the subsystem of norms and standards and the section "Social Development and Raising the Standard of Living of the People" of the plan for social development of the republic, oblast.

In the labor and personnel subbloc the group of functions ensuring the drafting of measures to develop the capability of agriculture near cities is most closely correlated with the ASPR at the republic level. Among these measures there is a need to single out only those aimed at multiple use of production waste and utilization of complexwide utility mains and heat and power supply. Indicators of the capital construction plan are calculated for the facilities of the agricultural capability around cities.

The planning of development of agriculture proper (including the sources of livestock feed) and food industry enterprises to process the products of agricultural complexes around cities remains the function of the ASPR at the republic and oblast level. Provision is made in the subbloc for the function of correlating capacities of complexes near cities with development of sources of livestock feed and sources of products for processing facilities.

The subbloc of optimum natural conservation and environmental protection is designed for performance of one of the most important functions in planning the TPK's formation. The planning process commences with analysis and possible amendment of standards reflecting optimum natural conservation. Planning is based on forecasts of reserves of natural resources and technical documentation reflecting creation of installations for natural conservation. Measures are drafted in the subbloc for optimum natural conservation and environmental protection, and the indicators of the capital construction plan for natural conservation installations are worked out. The subbloc is connected to the respective subsystems of the ASPR of the republic, oblast, and performs the function of reconciling and establishing the indicators of optimum natural conservation for the TPK in the plan of economic and social development of the republic, oblast.

The subbloc of methods support and improvement of management is aimed at performing two types of functions: working out the procedure for compilation of the plan for formation of the TPK, including development of a system of respective indicators, and solution of management-organizational and financial problems. The former refers to functions regulating compilation of the plan and inclusion of costs and other indicators in planning facilities common to clusters of enterprises. The functions of the latter type presuppose solving a number of organizational problems in management of the complex.

In the ASPR the process of drafting the plan is examined in the long-range, medium-term and annual planning frames, to which three types of plans correspond: the long-range plan, the 5-year plan, and the annual plan. The process of planning the formation of the TPK is examined in all time frames to achieve a mutual relationship with the process of planning the national economy and with the effort to monitor formation of the complex.

The reason why the long-range plan is necessary for the TPK is that we regard formation of the TPK as a part of a major regional program, which is an integral part of multiannual plans. During formation of the complex substantial shifts take place in the chart of location as well as changes in the regional organization of production, and the social and economic consequences of these can be assessed only from the long-range standpoint. Moreover, formation of target-program TPK's is based as a rule on bringing into production major deposits of natural resources, which entails solving a number of production-engineering problems which are worked out over the long run.

The 5-year plan is regarded as the principal component in the integrated system of plans. It concretizes the solutions of the long-range plan and brings its makeup into conformity with the assigned breakdown of the plan. Capital investment ceilings, the composition of capital investments and their distribution by measures and by years are the principal regulator and principal planning indicator for the 5-year plan for formation of TPK's. The process of capital construction becomes the principal subject of planning, and the capital construction plan becomes the principal plan. The decree of the CPSU Central Committee and USSR Council of Ministers provides (Point 28) as follows: "... USSR Gosplan shall: ... with the help of councils of ministers of union republics, USSR ministries and departments and the USSR Academy of Sciences draft programs for solving major regional problems and for shaping and developing the most important regional industrial complexes. It shall compile summary capital construction plans for those complexes."*

The annual plan is intended for carrying out the tasks of the 5-year plan and consequently also of the long-range plan. Indicators of the capital construction of the facilities of the complex and indicators of the functioning of capacities of the complexwide infrastructure and production operations comprising the complex's specialization which have been activated must be interrelated in the annual plan of the TPK.

The long-range plan is the plan on which the TPK is founded. For the TPK's long-range plan to be effective and concrete, it should be based on a number of preplanning documents prepared during the process of its compilation. Planning in the long-range frame consists of three stages: the stage of working out the conception, the stage of the main lines, and the stage of drafting the long-range plan.

The stage of working out the conception is characterized for a major regional problem by the working out of the goals of development and by the shaping of a scientifically sound conception of the spatial organization of the productive forces. The basic propositions of the major regional program as to the regional organization of production are concretized for the TPK in this stage. The result of the treatment done in this stage of the planning process is the master chart of the TPK. The master chart is intended for analysis of the proposed ways of achieving the goals and for concretization of the principles of the major regional program.**

In the stage of drafting the main lines of the TPK ways of solving the social, economic and scientific-technical problems outlined in the stage of working out the conception are selected and substantiated. The principal preplanning engineering and economic document in this stage is the TPK master project plan, which is taken as the basis for drafting the program for creation of the TPK--the list of measures necessary to achieving the goals of the TPK's formation.

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* "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality." Decree of the CPSU Central Committee and USSR Council of Ministers dated 12 July 1979, Moscow, Politizdat, 1979, p 31.

** Bandman, M. K., "Directions in Improving Preplanning Preparation and Planning and Management of the Process of Forming Target-Program TPK's," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, this issue.

These documents are the basis for compiling the long-range plan for formation of the TPK. In the stage of working out the proposed version of the long-range plan all the parameters of the complex are stated concretely, and the planning indicators are revised. The structure of the draft version of the long-range plan and its indicators and form are approximated to the organizational structure of the TPK's economy. They are derived from the tasks at which the TPK plan was aimed and from the need for correlation with the planning indicators of the national economy.

The target-program TPK bloc in the regional subsystem of the ASPR of USSR Gosplan is indeed intended for the purpose of including plans for formation of the TPK's in the overall system of national economic planning--for interlinkage of planning and preplanning documents of the TPK with the system of documents involved in the process of planning the entire national economy.

APPROACH TO OPTIMALIZATION OF THE SPATIAL STRUCTURE OF THE REGION'S ECONOMY

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 65-73

[Paper by M. K. Bandman]

[Text] The principle of stage-by-stage and element-by-element analysis of the components of a region's economy and of the gradual passage from solving the general problems to the particular, from the problems of forming the entire system of TPK's of an economic region to the problems of the development and location of individual elements of the economy and the regional subdivisions of each regional industrial combination (TPS) (Figure 1), has been laid down as the basis of the proposed logic flowchart of optimalization of the spatial structure.* Five stages are proposed for solving the overall problem. In all stages joint studies are made of production, the infrastructure, resources and the forms of regional organization of production.

In each stage of optimalization of the region's spatial structure and of its parts subjects of study of three basic types are identified: regional taxonomic units (districts [arealy], areas [ploshchadki], and sections [uchastki]), the functional elements of the economy (production, infrastructure, resources) and production-transportation connections. The possible set of regional taxonomic units and their characteristics and the composition of resources and variants of their utilization are determined before solution of the problem. In the process of optimalization of the spatial structure of the economy a selection is made of districts where production operations will be concentrated and where other elements of the economy will be located, the scale and directions for utilization of resources, above all local resources (land and water), are determined, and cost indicators are revised.

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* Bandman, M. K., "Territorial'no-proizvodstvennyye kompleksy: teoriya i praktika predplanovykh issledovaniy" [Regional Industrial Complexes: The Theory and Practice of Preplanning Studies], Novosibirsk, Nauka, 1979, 256 pp.

The composition and facilities of the sectors and industries comprising the specialization, the scale of production and the directions of the principal production connections are given in advance by the results of solving regional problems at the higher level.

Optimalization of the spatial structure of a region's economy and of its parts presupposes determination of the chart for location of facilities, the securing of their local resources and services of the infrastructure, and precise statement of production connections and certain technical-and-economic indicators. The composition and scale of development of production operations making up the complex are not given "from above." These indicators and also the chart for location and the connections among these given production operations are shaped and dated precisely in the process of solution by determining the need for their products of all the elements of the economy and the public of the region being studied so as to take into account the magnitude of local resources and the specific nature of the raw materials, production and the finished product.

It is not possible to solve the fundamental problems of shaping either the production infrastructure or indeed the social infrastructure without analyzing the region's economy. It is this indeed that determines the specific nature of the infrastructure as a subject of study and model-building. For certain facilities of the infrastructure whose importance extends outside the limits of the region being studied the assignment is given to satisfy the demand for their services on the part of regional units of higher rank. In the process of optimalizing the spatial structure of the economy the need for their services, the scale of development, the location of facilities and their connections are determined and costs precisely stated for all elements of the infrastructure.

On the basis of the solution a selection is made of sources of resources for natural resources, the scale and alternative versions of their development and the scheme of relations with consumers are determined, and costs are stated more precisely. Labor resources are distributed among elements of the economy and over the region, and a determination is made of the population of the principal settlements and of the costs of attracting people and setting them up [obustroystvo].

The makeup, scale, directions and methods of accomplishing the internal production-transportation (not including technological) connections are discovered in the process of optimalizing the spatial structure of the economy of the region being studied, while as a rule the external relations are given and are merely revised as a result of the solution.

In all stages the problems are solved under the condition of mandatory fulfillment of the assignment for deliveries of the products of the specialized sectors and industries and for development of the individual elements of the infrastructure whose importance extends outside the limits of the region under consideration. It is also necessary to take into account constraints concerning scarce resources and the specific nature of multifunctional facilities and also of individual portions of the region being studied.

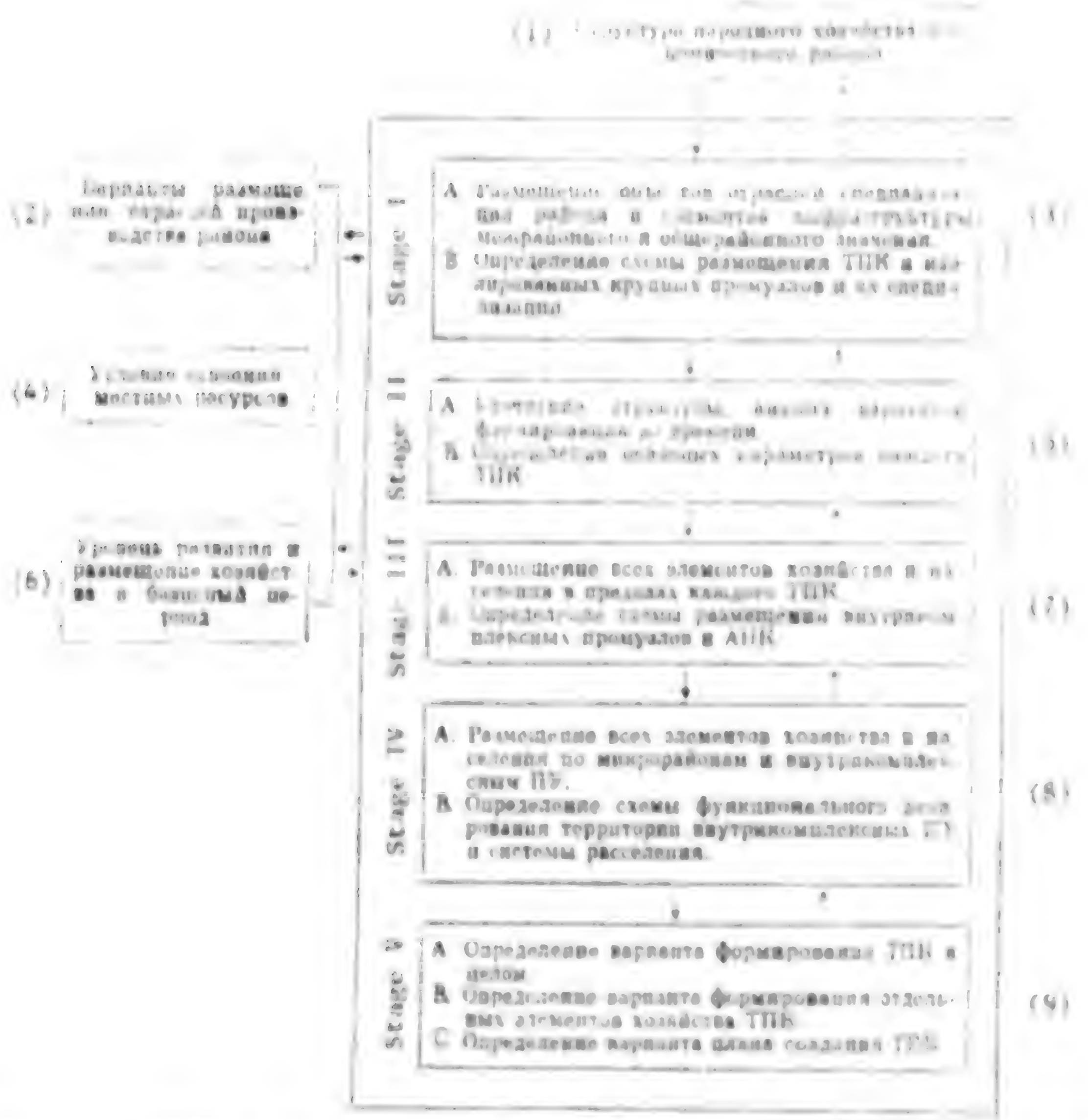
(1) Структура народного хозяйства экономического района
(2) Варианты размещения отраслей производства района
(4) Условия освоения местных ресурсов
(6) Уровень развития и размещение хозяйства в базисный период
Stage I
A Размещение объектов отраслей специализации района и элементов инфраструктуры межрайонного и общерайонного значения
B Определение схемы размещения ТПК и выделенных крупных промузлов и их специализации
(3)
Stage II
A Структура, функции, варианты формирования ТПК
B Определение основных параметров каждого ТПК
(5)
Stage III
A. Размещение всех элементов хозяйства и населения в пределах каждого ТПК
B. Определение схемы размещения внутрикомплексных промузлов в ТПК
(7)
Stage IV
A. Размещение всех элементов хозяйства и населения по микрорайонам и внутрикомплексным ПУ.
B. Определение схемы функционального зонирования территории внутрикомплексных ПУ и системы расселения.
(8)
Stage V
A Определение варианта формирования ТПК в целом
B. Определение варианта формирования отдельных элементов хозяйства ТПК
C Определение варианта плана создания ТПК
(9)

Figure 1. Stages in optimalizing the spatial structure of the economy of an economic region.

Key: 1. Structure of the national economy of the economic region
2. Versions of location of the production sectors and industries of the region
3. A. Location of facilities of the sectors and industries comprising the region's specialization and elements of the infrastructure of interregional and regionwide significance.

Key to Figure 1 (continued)

B. Determination of the chart of location of TPK's and isolated large industrial parks and their specialization

4. Conditions for development of local resources
5. A. Precise statement of the structure and analysis of alternatives of formation in time;
   B. Determination of the basic parameters of each TPK
6. Level of development and location of the economy in the base period
7. A. Location of all elements of the economy and the population within the limits of each TPK;
   B. Determination of the chart of location of intracomplex industrial parks and APK's [agroindustrial complex]
8. A. Location of all elements of the economy and the population by microareas and intracomplex PU's [industrial park];
   B. Determination of the scheme of functional zones of the area of intracomplex PU's and the system of settlement
9. A. Definition of the variant for formation of the TPK as a whole;
   B. Definition of the variant for formation of the individual elements of the economy of the TPK;
   C. Definition of the variant of the plan for construction of the TPK

Minimization of total imputed costs for the formation and functioning of the economy of the region under consideration was taken as the principal criterion of the optimality of the version of the spatial structure of the region's economy or of its parts in all stages of solving the problems.

As a result of solving the problems one determines the best version of utilization of resources, of location of industrial and agricultural production facilities, of the location and scale of development of elements of the infrastructure, of the scheme for accomplishing internal and external transportation connections, of the system of settlement, of the location of principal intraregional complexes, and of their specialization, scale of development and connections that is best from the standpoint of economy in expenditures of social labor.

When there are common features inherent in the problems in all stages of the study, each stage is distinguished not only by the purpose of the study, but also by the content of the specific posing of the problem and consequently by the set of instruments used in the study (see Figure 2 and the table).*

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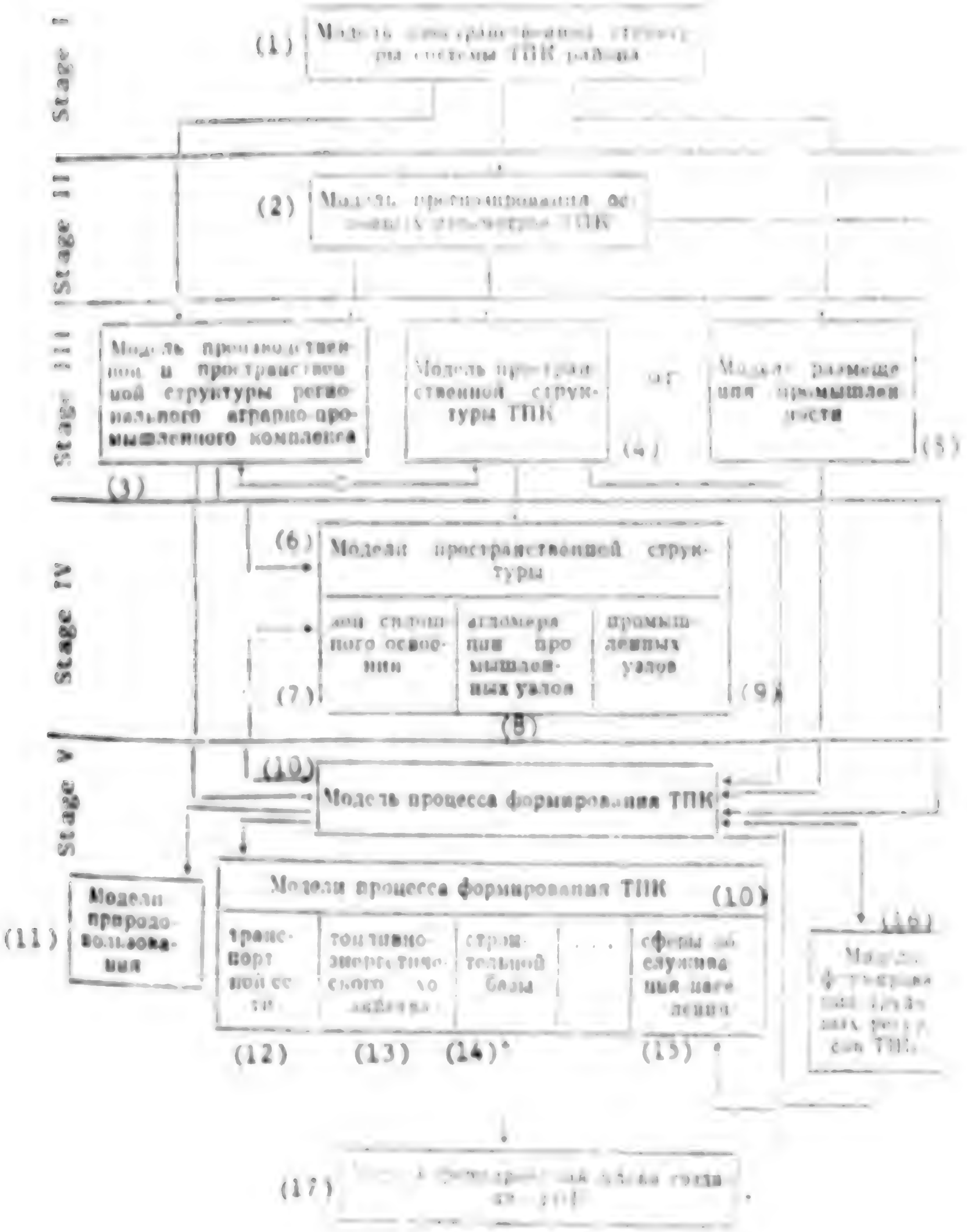
* "Modelirovaniye formirovaniya territorial'no-proizvodstvennykh kompleksov" [Model-Building of Formation of Regional Industrial Complexes], Novosibirsk, Nauka, 1976, 338 pp; "Metody analiza i modeli struktury territorial'no-proizvodstvennykh kompleksov" [Methods of Analysis and Models of the Structure of Regional Industrial Complexes], Novosibirsk, Nauka, 1979, 310 pp.



Stage I
Stage II
Stage III
Stage IV
Stage V
(1)
Модель пространственной структуры системы ТПК района
(2)
Модель прогнозирования основных параметров ТПК
Модель производственной и пространственной структуры регионального аграрно-промышленного комплекса
(3)
Модель пространственной структуры ТПК
(4)
Модель размещения промышленности
(5)
(6)
Модели пространственной структуры
зон сплошного освоения
агломерации промышленных узлов
промышленных узлов
(7)
(8)
(9)
(10)
Модель процесса формирования ТПК
Модели процесса формирования ТПК
(10)
(11)
Модели природопользования
транспортной сети
топливно-энергетического комплекса
строительной базы
. . .
сферы обслуживания населения
(12)
(13)
(14)
(15)
(16)
(17)

Figure 2. Group of models for optimization of formation of a TPK.

Key:
1. Model of the spatial structure of the region's system of TPK's
2. Model for forecasting the principal parameters of TPK's
3. Model of the production and spatial structure of the regional agroindustrial complex
4. Model of the spatial structure of the TPK
5. Model of location of the industrial sector

Key to Figure 2 (continued)

6. Models of the spatial structure
7. Zones of continuous development
8. Of an agglomeration of industrial parks
9. Of industrial parks
10. Model of the process of TPK formation
11. Models of natural conservation
12. Of the transportation network
13. Of the fuel and power industry
14. Of the construction capability
15. Of the sphere of services to the public
16. Models for formation of the labor resources of TPK's
17. Model of shaping the plan for construction of the TPK

The problems which we propose to solve can be divided into three types: a) determination of the variant of the spatial structure of the economy of each TPS; b) analysis of the process of forming each individual TPS as a whole; c) determination of the version for formation of the particular elements of the infrastructure and the plan for construction of each TPS.

The problem of the first type can be formulated in its general form as follows: to determine the version of use of resources, location of production operations and elements of the infrastructure of the respective TPS under the condition that they fulfill their role in the regional division of labor. The content of problems of the second type is this: for individual intraregional TPS a check is made of the correspondence and consistency of dates for creation and development of the facilities of the sectors and industries comprising specialization, the production operations rounding out the complex and the elements of the infrastructure, and the utilization of resources. The purpose of solving problems of the third type is to state more precisely the version of location, connections, rates of development and structure of each of the forms of infrastructure of the relevant TPS.

A major portion of the elements of the group of models for optimalization of formation of the TPK and all the proposed stages have beer experimentally tested in solving a series of problems for the TPK's of the Angara--Yenisey region* and for individual TPK's in other regions of Siberia (the Middle Ob' and South Yakutia TPK's).

Description of the Stages of the Study

Stage I:

Rank of the TPS: Economic region

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* "Formirovaniye territorial'no-proizvodstvennykh kompleksov Angaro-Yeniseyskogo regiona" [Formation of Territorial Industrial Complexes of the Angara--Yenisey Region], Novosibirsk, Nauka, 1975, 176 pp.

Goal: Identification of the system of TPK's and their specialization

Content: Optimalization of the development and location of projects comprising the sectors and industries that represent specialization and the elements of the infrastructure which have interregional and regionwide importance

Models used: Spatial structure of the system of the region's TPK's

Results of solutions: 1) Chart of development and location of sectors and industries comprising specialization and elements of the infrastructure; 2) Chart of location of TPK's; 3) Variant of specialization of each TPK

Preplanning documents: Master chart of development and location of the country's productive forces; Master chart of development of the region's productive forces

Stage II:

Rank of the TPS: TPK

Goal: Determination of the proportions in development of the principal elements of the economy

Content: Optimalization of the rates and scale of development of interrelated facilities in the sectors and industries comprising specialization and the infrastructure and of utilization of resources in time

Models used: Forecasting the basic parameters of TPK's

Results of solutions: Version of the order of priority, rates and scales of development of interrelated projects and of distribution of resources in time

Preplanning documents: Feasibility studies (technical-and-economic substantiations) of area layout schemes; Master charts of development of the production branches of the USSR

Stage III:

Rank of the TPS: TPK

Goal: Determination of the chart of location of the productive forces

Content: Optimalization of the development and location of all elements of the economy and of utilization of resources

Models used: 1) Spatial structure of the TPK; 2) Production structure of the regional agroindustrial complex; 3) Location of the industrial sector

Results of solutions: 1) Chart of development and location of the productive forces; 2) Chart of location of intracomplex PU's; 3) Variant of specialization of PU's

Preplanning documents: Master chart of development of the region's productive forces; Master chart of development of the productive forces of the TPK

Stage IV:

Rank of the TPS: PU

Goal: Determination of the spatial structure

Content: Optimalization of the development and location of intra-PU elements of the economy and of utilization of resources (and correspondingly of an agglomeration of PU's and zones of continuous development)

Models used: Spatial structure of the PU (of the agglomeration or zones of continuous development)

Results of solutions: Variants: 1) Of the functional zones of the area; 2) Of development and location of production operations rounding out the complex and of elements of the infrastructure of PU-wide and intersettlement importance; 3) Of utilization of resources; 4) Of the basis of the system of settlement

Preplanning documents: Area layout scheme; Scheme of the region's system of settlement; scheme for environmental protection and reproduction of the region's resources

Stage V:

Rank of the TPS: TPK

Goal: Definition of the flowchart of the process of its formation and drafting the plan of its creation

Content: Optimalization of development of all elements of the economy and of the sequence and dates of their creation

Models used: 1) Process of formation of the TPK; 2) Formation of the infrastructure; 3) Formation of labor resources; 4) Plan for construction of the TPK

Results of solutions: Information on rates and dates of development of individual elements of the economy and of the TPK as a whole

Preplanning documents: Charts of development of the particular sectors of the region's economy; Charts of the master plans of industrial parks

Universality of the Flowchart, Conditions and Directions of Possible Modification. We do not regard the stages, the content of the overall problem and the goals of each stage as described above as a universal flowchart for optimalization of the formation of any TPK. The great diversity of the content of the problems which creation of a TPK involves, of the conditions of the regions where they are formed and of the goals of the specific studies may make it necessary to make certain adjustments in the content of the problems and to modify the logic flowchart of their solution.

We can identify a number of factors which would make it necessary to revise the content of the overall problem: economic-geographic position, the initial base or foundation for formation of the TPK, the level of preparation of the infrastructure, the phase of the complex's creation, and the situation for creation of the TPK. Each of these factors is characterized in turn by a set of characteristics whose combination in fact determines the direction for adjustment of the content of the problem.

The need to modify the logic flowchart for optimalization of formation of a TPK (number of stages) might arise because of the differing character of the national economic problem from the standpoint of the closeness of connections with other problems and also with other elements of the region's economy; in connection with the composition and location of resources and facilities related to fulfillment of the program for solving the particular problem; and with the practical orientation of the study from the standpoint of the time frame and phase of planning.

In all possible combinations of these factors the greatest impact is exerted on the content of the problem by the phase of creation and the situation in which formation of target-program TPK's is taking place. Accordingly two varieties of problems are distinguished: a) determination of the version for formation of new TPK's within the limits of underdeveloped regions of the country; b) determination of the version for formation of a new TPK in a developed part of the country or the version of a new phase in intensive formation of TPK's that already exist.

In the first case it is necessary to locate major new projects within the confines of the underdeveloped region and to determine accordingly a variant of development and location of production operations rounding out the complex and the infrastructure, to outline the system of settlement and the scheme of socioeconomic and production connections, in other words, to determine in advance the skeleton and foundation of the spatial structure of the economy over a period of many years. In the second case one needs to inscribe new projects in the existing regional system and to optimalize the process of mutual adaptation of the new and already existing elements of the economy (for example, the TPK based on the Kursk Magnetic Anomaly) or to find a version for increasing the efficiency of the economy by improving the production structure, spatial structure and organizational structure and by redistribution of the resources of the TPK's that already exist. In this case more attention will be paid than in the problems covered by the first situation to aspects of migration of the elements of the economy and the population, to deconcentration of production and population in overloaded parks, strategies for development of small and medium-sized cities, reorganization of the infrastructural system, etc.

The other factors identified above do not give rise to the occurrence of problems which are new in their content. They have to be taken into account for posing problems in detail, and their influence is reflected in the indicators of the possible flowchart for solving all four varieties of problems. On the whole, in spite of such substantial differences in the content of the problems, the basic initial principles of the approach and of the flowchart of the solution remain the same. The difference between problems is manifested only in the internal structure of the instrument--the models, but in our opinion the overall architecture of the models and the contours of the logic flowchart are retained.

Under the influence of these two groups of causes a situation may come about in which it will be necessary to carry out all five stages of solving the overall problem. For example, to define the version of the Mangyshlak TPK it was not necessary to solve the problem for Kazakhstan as a whole. There was a straightforward assignment outlining the scale, pace and time for formation of the base of the petroleum industry on the east bank of the Caspian Sea, and performance of that assignment had more to do with the country's other regions than with other TPK's of Kazakhstan. The basic connections as to shipping out of the product and receiving a sizable portion of necessary resources were in fact predetermined outside Kazakhstan.

The situation is similar with the South Yakutia TPK: the goal of its creation was clear, and the district in which it was to be realized had been found. Determination of the version for formation of the South Yakutia TPK was possible not only without examining Yakutskaya ASSR or the entire zone of the BAM, but also without examining the territory of neighboring oblasts. The complex's connections with them were sufficiently obvious and could be taken into account as external conditions. In this case it was possible to start solving the problems from the level of the individual TPK and to omit the stages of joint examination of the entire system of the region's TPK's.

The situation was also analogous in solving the problem for the Middle Ob' TPK. Definition of the version of the first stage of its formation did not require a prior solution of the problem for the entire West Siberian region. The interrelationship between the Middle Ob' and Kuzbass TPK's in the formation of the country's fuel and power balance was determined before solving the problems for the TPK and was inserted into the problem from outside in the form of constraints. In the first stage of developing the West Siberian Plain, when individual deposits of petroleum and gas went into exploitation, the versions for formation of the Middle Ob' (like the Mangyshlak) TPK and industrial parks in the north of Tyumenskaya Oblast were examined in isolation; there was no need for the regional problem. At the present time, when the second stage of solving the problem of forming the new base of the petroleum, gas and petrochemical industries of the country has begun and the problem has arisen of creating a system of TPS's and of corresponding development of the infrastructure, the situation has changed. In that context it is hardly advisable to examine the Middle Ob' TPK apart from a portion of Tomskaya Oblast and the south and north of Tyumenskaya Oblast. And probably it is altogether out of the question to examine a version for development of the gas deposits of the North without the Middle Ob' TPK. The importance of joint solution increases because of broad introduction of the tour-of-duty and expeditionary methods of organizing work, because of creation of the system of support base facilities of construction, of material and technical supply, sources of food, and because of formation of the transportation network and the system for supply of fuel and power.

Thus the problem of selecting the variant of formation of the production and spatial structures of TPK's which will be created in connection with the second stage of developing petroleum and gas resources requires joint consideration of a huge region within the West Siberian Plain and carrying out the entire flowchart for five-stage solution.

The situation for formation of target-program TPK's within the Angara--Yenisey region is fundamentally different. The solution of these interrelated major national economic problems (creation of national sources of electric power, energy-intensive production operations and comprehensive use of timber) determines the ways and directions of development of this region's productive forces. The most favorable districts for location of projects related to solving all three problems also coincide. Differing combinations of these projects comprise the foundation of the region. The complexes possess approximately equal prerequisites for development of production operations of the various particular types. As a result the sectors and industries end up being competitors and assert claims for one and the same resources of the individual TPK's, and the complexes themselves compete with one another in the distribution of assignments and in selection of sites for location of projects belonging to the sectors and industries comprising the region's specialization. Moreover, a single production infrastructure and agricultural capability are being formed in the region. All of this precludes the possibility of locating projects on the basis of solution of only sectoral problems and of an examination of the formation of the individual TPK apart from the problem embracing the entire region where all three problems are being solved, i.e., without joint examination of the entire system of the region's TPK's, without the first stage in the flowchart for solving the overall problem of optimalizing formation of TPK's.

The advisability of simplifying the overall flowchart of the solution, its modification, might result not only from the specific features of individual national economic problems or regions, but also from the differing practical orientation of the study to be conducted. The latter may be in the form of preliminary reconnaissance or may be intended for compiling a specific planning document; the principal subject of this study may be only the problem as a whole and the region where it is to be solved or the problem along with detailed treatment of the parts, an analysis of the region's spatial structure, and so on, i.e., the studies require differing degrees of detail. From this standpoint we can identify two classes of problems.

The first class would include problems in which the principal subject of investigation is the problem as a whole and where it is necessary to discover the overall scheme of the system of TPK's in the region where it is to be solved. In this case, depending on the purpose of the work, one can limit himself to solving the problems only of the first stage, or the two initial stages or the first three stages. The second class includes problems in which the study covers not only the problem as a whole, but also its individual components and in which there is a need to obtain a detailed scheme of the region's spatial structure. This necessitates performing all size stages of the solution and a detailed analysis of the structure of the TPK's or industrial parks (depending on the purpose). In solving both classes of problems each stage of the solution preceding the principal one is an information stage, and each subsequent stage is a correcting stage (see Figure 1).

In problems of the first class the information--assignments for development of the sectors and industries comprising specialization and limits on external resources--take shape from the results of solving the problems at the higher level and is corrected in the first stage of study of the region when the production structure of the region as a whole is being optimalized. Optimalization of the spatial structure of the region as a whole is the problem of the first phase of the second stage of studying the region. For tasks in the first class it is the basic one, while tasks in the second and third stages (if they are solved)--determination of the basic parameters of the individual TPK or optimalization of the spatial structure of the individual TPK--are corrective stages. The latter obtain information from the principal stage, and more precise data are in turn fed back into the problem of the first stage for adjustment of the indicators (mainly cost indicators and constraints pertaining to local resources of the principal problem, i.e., the problem of the upper level.

To solve problems in the second class we must not only solve all five stages, but also obtain a more detailed conception of the respective subjects of planning in the third (TPK) and fourth (PU) stages. To solve the problems for the individual TPK we must first solve the problem for the region as a whole, and for the problem related to the industrial park, we must solve the problem for the respective TPK. For example, in studying a region in which each TPK is regarded as an independent subject of planning, the proposal calls for solving not only the actual problem of optimalizing the spatial structure of the individual TPK (see Figures 1 and 2), but also the problems of forecasting the principal parameters of the TPK's, optimalization of the process of forming the TPK's and determination of the plan for creating the complex. It is assumed that the problem of the first stage (optimalization of the spatial structure of the region as a whole) and the problem of the fourth stage (spatial structure of industrial parks) are solved in advance. The problem of the first stage is indispensable to build up the initial information, and the problem of the fourth stage is necessary for adjustment of the results of solving the problems in the second and third stages.

The sector for formation of TPK's of the IEiOPP SO AN SSSR has not had sufficient experience in solving problems for TPK's with an existing economic structure. But we believe that the overall conception of the approach, the flowchart for solving the problem as a whole and the type of models, though they were intended for optimalization of formation of TPK's of a particular type, might also be extended to studying the structure of complexes which have taken shape. In this case one would in the first stage treat not the system of the region's TPK's, but the union republic or economic region whose components are the krays, oblasts, and ASSR's; in subsequent stages the subjects of the study would then be the TPK's which have taken shape of the krays, oblasts and ASSR's, and thereafter agglomerations of industrial parks or individual PU's. The point is that in spite of substantial differences between overall territorial systems, including between two types of TPK's (traditional TPK and target-program TPK), resulting by and large from the functions assigned to each, these systems, as already noted above, have many of the same features and formational principles.

PROBLEMS IN STUDYING TPK'S IN REGIONS WITH AN EXISTING PRODUCTION STRUCTURE

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 73-76

[Paper by R. M. Artyushkova]

[Text] The relatively high level of economic potential already built up is the main and fundamental feature distinguishing regions with an existing production structure from regions of new economic development. The term "potential" [potentsial] has been frequently encountered of late in the economic literature, but so far opinions do not completely agree on its composition and quantitative expression. In our view the components of the economic potential are the capacities of industrial enterprises, infrastructural facilities, and resources (they would include both local natural resources and also labor resources). In addition, this is a vector quantity which should be expressed by a set of indicators. The area they cover might be sufficiently broad, but the number and the set are determined by the specific goals of the study being conducted.

In analyzing the regions under consideration it is important to know the relationship between the potential that has been built up and the possibilities for further development of the area. On the one hand the level of the potential already built and above all reserves for each of its components largely determine prospects for development of the region's economy. The most important roles are played in this by the infrastructural and resource components. On the other hand realization of the possibilities that exist could bring about substantial changes, both quantitative and qualitative, in the structure that has already taken shape. Our interest in the potential that has been built up is not confined to the level and scale of development. Its structure and the degree of completion and proportionality in development of all elements are by no means a matter of indifference. An analysis of the prospects for a region's development should show whether the area has possibilities for a qualitative leap, for a radical restructuring of the economy as it has been formed, a restructuring that would greatly strengthen the role of the region and increase the operational efficiency of all elements of the economy or reserves sufficient only for quantitative growth at a more or less high rate. Here we cannot lose sight of the relationship among the possibilities for development of the individual elements of the economic potential.

The basic task in further economic development in regions with an existing economic structure is to increase its operational efficiency thanks to comprehensive use of the economic potential that has been built and the existing reserves.

In our view the means of performing this task should be solution of a number of production, social and resource problems. Especially important among the production problems is carrying out reconstruction and modernization of fixed productive capital. The present stage of development of scientific-technical progress makes it possible to carry out these measures at a higher technical level and thereby to solve a number of important socioeconomic problems. In particular, in order to raise the operational efficiency of a region's economy one must solve the problem of moving production operations outside the complex whose location within it did not have the economic or resource prerequisites. These are what are called "extraneous" production operations as well as the facilities which for one reason or another cannot expand or function at all within the complex.

In regions with an existing economic structure specialization is strictly defined, but in the process of future operations certain industries might give up the role of the industries comprising the specialization, since the factors are disappearing which brought about their previous development. For example, the extractive industries may deplete their sources of raw materials. For such situations it is important to find effective lines of further development and to reorient the region in good time toward development of other sectors of the economy.

An important direction for increasing the operational efficiency of the economy of areas which have already been developed is to develop production operations that round out the complex and facilities of the infrastructure. Above all this means eliminating existing disproportions between the principal and auxiliary production operations, whose existence detracts considerably from the effectiveness of the regional organization of the productive forces, carrying out reconstruction and modernization of technical equipment, and the discovery and utilization of unused potential. It is an acute problem to strengthen the functional specialization of enterprises, i.e., to separate and consolidate auxiliary and repair shops and to set up specialized production facilities that have a higher level of labor productivity.

The solving of social problems has the most essential importance to further economic development of areas which have already been developed: redistribution of labor resources between sectors of the complex's economy, elimination of disproportions in the age-sex-specific composition of the population, and improvement of the system of settlement. Timely reconstruction of the housing stock is important, and in small and medium-sized cities where the stock consists largely of low and homestead buildings, it is important to find more flexible forms of carrying out reconstruction. In large cities it becomes especially important to expand urban centers and to build express highways. It is a very urgent problem to expand the sphere of application of labor in small and medium-sized cities, since their level of development, social amenities and services to the public is substantially lower than in large cities, and this gap is becoming progressively larger as time passes. The solving of social problems also includes an entire set of measures related to the system of cultural and consumer services to the public. The operational efficiency of a TPK's economy can be raised through optimum redistribution of local resources so as to take into account the interests of environmental protection.

The solution to this problem also depends on the ways open for the complex's future development. One of them is the evolutionary strategy, gradual growth by utilizing the existing reserves and by increasing the efficiency of utilization of the potential that has been built up. We call this the traditional strategy. Another strategy is to change the pace and scale of the region's development and its role in the regional division of labor in one leap. If a program has been drafted to solve this problem, the complex's economic development has the attributes of target-program development.

Traditional TPK's develop on the basis of plans of ministries for particular sectors and industries operating in the complex, which is why imbalances may occur. To eliminate them indicators for the TPK to be formed in the given region must be given separately in the oblast's plan of economic and social development. These indicators should cover the medium-term period and should accomplish the customary evolutionary strategy for economic development within the framework of sectoral analyses. In this case an essential role is given to discovering and utilizing reserves embodied in the economic potential that has been built and to reconstruction and modernization of elements of the complex's economy. New construction and location of projects are limited only to those enterprises which are indispensable to improving the structure of the existing complex or which result from the needs of the region as a whole.

When a target-program TPK is being formed, a unified program is set for the region's development, and its fulfillment presupposes a leapwise growth of the production of the industries comprising specialization, as a rule thanks to new construction or substantial expansion of existing facilities. This necessitates either construction or substantial development of the facilities of the production infrastructure and of auxiliary and supporting service operations. Consequently the changes affect not only the facilities envisaged in the program, but even a major portion of the region's economy. Although the target-program TPK is being formed under the conditions of an existing economic structure, new construction in the framework of carrying out the program is quite dominant and determines the development of the sectors of the economy which have already been created. Drafting the program means forecasting the region's development over the long run, assuming the imbalances have been removed. Thus in forming a target-program TPK in regions with an existing production structure where the specialization has already been defined, it undergoes a further substantial bolstering, and the role of the region in the regional division of labor increases sharply. In the development of a traditional TPK improvement of the existing production structure does take place, and in a number of cases it is possible to alter the region's specialization either partially or even completely.

In spite of the differences we have noted, both types of TPK's are a special form of socialist organization of the productive forces thanks to their possession of a number of common features: a) the ultimate goals of their formation, which are determined by the ultimate goal of development of the productive forces of socialist society; b) the objective laws that are the basis of their creation, the laws of conformity to plan and of proportional development; c) the principles governing their formation--the interlocking nature, interrelatedness and mutual dependence of the development of all elements of the complex.

The features which the traditional and target-program TPK's have in common determine the existence of a dialectical relationship between them. Target-program TPK's lose their specific features and become a part of the traditional complex as they proceed in their development and as all the facilities make the transition to the pattern of permanent operation (for example, development of the Kuzbass TPK). Movement in the opposite direction is also possible, when a traditional complex takes on the features of a target-program complex as a consequence of the region's participation in solving a major regional problem (development of the TPK on the basis of the Kursk Magnetic Anomaly).

The features which the two types of complexes have in common make it possible to use a single set of tools in studying them. The group of models developed in an IEiOPP SO AN SSSR for optimalizing formation of TPK's* has by and large been tested in solving problems pertaining to target-program TPK's in regions undergoing new economic development. The peculiarities of regions with an existing economic structure and the specific content of the optimalization problem require modification of the models. In our view the modification is not so extensive as to speak of another type of model. The type of model remains the same; the changes pertain to the particular conditions of more detailed representation of certain blocs. In any case the mathematical representation is not so important as analysis of the content of the conditions and results of the solution. Consequently, the group of models that has been developed, and in particular the model for optimalization of the spatial structure of the TPK, can be used in studies concerning the development of TPK's in regions with an existing economic structure.

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* "Modelirovaniye formirovaniya territorial'no-proizvodstvennykh kompleksov" [Modeling the Formation of Regional Industrial Complexes], Novosibirsk, Nauka, 1976, 334 pp.

EXPERIENCE IN FORECASTING THE PRODUCTION AND SPATIAL STRUCTURES OF THE SYSTEM OF TPK'S OF THE ANGARA--YENISEY REGION

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 76-95

[Paper by M. K. Bandman, V. V. Vorob'yeva, V. D. Ionova, M. A. Malinovskaya and V. Yu. Malov]

[Text] Within the Angara--Yenisey region Krasnoyarskiy Kray will undergo the greatest development in the future, in particular its central and southern portions. By comparison with the rest of the region's area, these regions have undergone more economic development, they are inhabited, and they have a fairly developed infrastructure.

The existence of a set of alternative versions of location of the productive forces within a region, a kray, or a particular complex, the diversity of economic-geographic conditions, and the differing level of development of individual regions makes it necessary to solve optimalization problems to determine the production and spatial structure of TPS's over a given period.

A group of models of TPK's developed in the Sector for TPK Formation of the IEiOPP SO AN SSSR was used to optimalize the spatial structure of the economy of the Angara--Yenisey region, Krasnoyarskiy Kray, and the Sayan and Lower Angara complexes.* The problems were solved over the period up to the year 2000 for these TPS's one after the other. The purpose of solving each of the problems was to determine the optimum version of location of new production operations under the condition of their having transportation, electric power supply, the services of construction capabilities, and attainment of the projected standard of living of the population. The optimality criterion in the problems was minimization of total imputed costs of carrying out the assigned production program.

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* "Modelirovaniye formirovaniya territorial'no-proizvodstvennykh kompleksov," Novosibirsk, 1976, 334 pp.

The area (ploshchadka)--a compact space suitable for industrial construction, civil engineering or agricultural use and possessing approximately equal conditions for construction and operation of projects--was taken as the principal taxonomic unit in the problems. At the level of the region areas similar in their characteristics are combined to form districts (arealy). The basis for formation of a TPK is a district or combination of districts, and the basis for creation of an industrial park is the area. In moving from a higher rank of problem to a lower one a more detailed analysis of the region is made. For instance, whereas the portion of Krasnoyarskiy Kray in the Angara--Yenisey problem (a total of 13 districts) is represented by 6 districts, in the Krasnoyarskiy problem there are now 19, and when we take up the Sayan Complex 1 district "becomes" 12 areas.

These districts differ in their natural and climatic conditions, in their supply of raw materials, in the availability of local resources, in the extent to which the infrastructure has been developed, and so on. Moreover, we observe "contrasting" combinations of these conditions in particular portions of the region: the Lower Angara Valley, a region which is uninhabited and undeveloped, possesses large hydropower resources, mineral resources, timber resources and practically unlimited local resources; the south of Krasnoyarskiy Kray, which has gone farthest in development and is most favorable for the life of the population from the standpoint of natural and climatic conditions (within Siberia), is not distinguished by large reserves of minerals; the Chulym Valley region, which is unique for large-scale development of coal mining, does not have adequate opportunities for building major power facilities (the region is poorly supplied with water resources and is characterized by unfavorable natural conditions for building large GRES--should they be built, substantial measures would have to be taken to protect the environment). The existence of favorable and unfavorable conditions and factors has a substantial impact on the concentration and combination of new production operations in a particular district of a given region.

Selection of the principal production operations for location in a region was determined above all by the availability of electric power, fuel, mineral raw materials, timber and local resources (land and water). They include energy-intensive production operations of nonferrous metallurgy (aluminum), ferrous metallurgy (ferroalloys and quality steel); production operations using unique local raw materials (lead-zinc, copper-nickel, electrochemical, manufactured fertilizers, and so on). Practically all the production operations of the chemical industry, nonferrous metallurgy and ferrous metallurgy require sizable sites and zones for public health protection and a large amount of water, and they have harmful effluents.

Ferrous metallurgy might be represented in the Angara--Yenisey region by a metallurgical combine with the full production cycle of pig iron and steel (according to numerous proposals and work done by project planning institutes its location has been assigned to the Tayshet district) and by an electrometallurgical combine consisting of three plants: quality steel, ferroalloys and metal products.

Earlier these production operations were regarded as part of the complex of the East Siberian Electrometallurgical Combine (VSEMK). The head project planning institute proposed an area for construction of the VSEMK--the region of the village Tesi in the south of Krasnoyarskiy Kray. But a more detailed analysis of this version by Krasnoyarskgrazhdanproyekt [Civil Engineering Project Planning Office of Krasnoyarskiy Kray] and IEiOPP SO AN SSSR revealed large losses of agricultural production because of the highly productive land in the region that would be taken away for the project. Combining these three production operations in a single area is effective because of their close technological relations. But a decision was made to examine the possibility of separate location of the production operations within the region. This is all the more legitimate because should the country's needs for quality steel be satisfied in the near future thanks to construction of additional capacities in the western regions, construction of the ferroalloy plant is conceived only in the eastern regions (because of its high energy intensiveness--about 6,300 kilowatt-hours per ton of the finished product), even if a sizable amount of raw materials have to be brought in from the west. The need to build a plant for quality steel (in the more remote future) in the region is explained by the growing need for metal of all sectors of the economy in Eastern Siberia. The proposed enterprises of ferrous metallurgy are the largest consumers of land (about 2,000 hectares of land would be taken for construction of the VSEMK alone) and labor resources (about 50,000 persons).

The region's nonferrous metallurgy is represented by a number of energy-intensive production operations--aluminum, copper-nickel, lead-zinc, titanium-magnesium, and manufacturing of nonferrous metals. Future location of aluminum plants pursues the line of development of the aluminum industry in Eastern Siberia, where the Irkutsk, Krasnoyarsk, Bratsk, Sayanskiy and Ust'-Ilimsk plants are already in operation or under construction. The reason for building a copper-nickel plant in this region is the need to move a part of the capacity of the Noril'sk Mining and Metallurgical Combine for copper and nickel production to more southern parts. The concentrate can be carried by water along the Yenisey (until the railroad is built). The correctness of locating the lead-zinc and titanium-magnesium production operations in the region is proven by the proximity of large reserves of local raw materials. Inclusion in this version of a plant for manufacturing products of nonferrous metals is justified by the location here of enterprises of nonferrous metallurgy producing copper, nickel, aluminum, lead, and zinc and the need for rolled products of nonferrous metals of branches of the fuel and power industry and machinebuilding which are developing in the kray.

Among enterprises of the chemical industry consideration is given to a large petroleum-coal-electrochemical combine (NUEKhK), based on integrated combination of petrochemistry, coal chemistry and electrochemistry in the production process. Only the preliminary scientific work has been done on its makeup, its capacity, and so on. Nevertheless, the decision was made to include it in the production structure of the economy, especially over the long run. An abundant source of raw materials for this extremely large production operation is concentrated in the region: petroleum, brown coal, common salt, electric power and thermal energy, and water resources. We should note in addition that after 1990 it will be possible to use construction workers now employed in building the Tomsk and Tobol'sk petrochemical complexes. The assumed freight traffic of the NUEKhK is huge--about 45-50 million tons of raw materials; it is moreover assumed that the combine would be supplied with the principal raw materials by pipeline.

Production of industrial rubber goods is regarded as a consumer of the products of the petroleum-coal-chemical combine. Its development is in turn determined by the requirement of creating special transportation equipment for operation under the conditions of the North.

Production of synthetic fibers is based on use of the products of these production operations in nonferrous metallurgy and petrochemistry. This is a water-intensive enterprise that is distinguished not so much by the amount of water consumed in the manufacturing process as the need for a substantial amount of water to dilute harmful effluents. That is why its location is foreseen in the Angara Valley region, especially since there is already a large synthetic fiber plant in the kray's central zone.

The possibility of locating four aggregated groups of machinebuilding was adopted for the future. The products they would produce would meet the needs of Siberian consumers. These would be excavators, mining equipment for working coal and ore deposits, boilers and other power engineering equipment for generating heat and power, trucks and agricultural machines.

The creation of timber and lumber complexes and pulp and paper combines is based on the large timber, fuel and water resources of the region.

Two production operations would be the largest consumers of all resources: the manufacturers of quality steel and the petroleum-coal-electrochemical complex. The operation of the former requires almost one-fifth of the resources to be consumed by the new production operations: labor, fuel and power, and land. The latter would take first place in consumption of all resources (except labor) and thus becomes the most capital-intensive, energy-intensive and water-intensive production operation, one requiring a large amount of land for its site, and it is also one of the most harmful in terms of harmful emissions and effluents. The wood manufacturing enterprises and pulp and paper industry are major consumers of water resources.

The conditions for the formation and operation of the production operations are represented in the problem by alternative versions of their possible location and production connections. The initial information for each production operation consists of indicators of output, rates of consumption of raw materials and electric power, and the needs for local and labor resources. Consideration was also given to the need for resources of those production operations which are operating or are being built within the districts or areas under consideration. On this basis figures were obtained for constraints and utilization of local resources for location of new production operations.

The infrastructure in these problems is divided into the production infrastructure and the social infrastructure, which are presented with a differing degree of detail. The production infrastructure includes transportation, the fuel and power industry, and construction capabilities. Formation of the transportation network, for example, depends on the chart for location of production operations, their concentration by districts or areas, the scale and directions of intraregional and interregional production connections. All of this has an impact on the shaping of the configuration of the transportation network (creation of new links and junctions) and on the supply of transportation equipment. On the other hand the level of development of the region's transportation system and its individual parts has an essential impact on shaping the scheme for the location of production operations (especially those which are materials intensive) and is one of the factors in their location. At the upper level transportation connections are represented by interdistrict shipments on main line transport, power connections are represented by the system-forming long-distance power transmission line of the Unified Electric Power System of Siberia, and in the problems of the Sayan Complex consideration is given to transportation connections with each construction site and local electric power transmission line.

In shaping the indicator of the functional the constant (not changing as a function of the district or area of location) portion of outlays to build projects and the operating costs of production operations was omitted from the total amount of costs of building the industrial projects. This can be done at all levels of the problems posed, since they are not being used to settle the question of selecting the production specialization of the region or complex, or their structure and the capacity of individual production operations. Posing the problem requires determination of the spatial structure of the economy of the region or complex. For that reason a sizable portion of capital investments to build industrial projects of the industries representing specialization will remain unchanged in the alternative versions of location. The costs of construction and installation work change when production operations are specifically assigned to a district or area as a function of more expensive or less expensive factors: their location, land occupancy and construction characteristics.

TPK's of the Angara--Yenisey Region

Within the region 14 districts were selected for location of production projects (see the table). Moreover, since we propose to solve the separate problem of defining the spatial structure of Krasnoyarskiy Kray, Irkutskaya Oblast was examined in more detail in this case. The districts within it represent possible industrial parks or characterize the possibility of development of parks that have been formed or are now in formation. The latter include the Bratsk, Ust'-Ilimsk and Cheremkhovo districts. The Tayshet, Tulun and Balagansk are potential districts for further development of industrial parks.

In Krasnoyarskiy Kray the districts for possible concentration of new production projects are represented in more consolidated form in the problem and embrace large zones of industrial development or entire TPK's. For instance, the Central Krasnoyarsk TPK is represented in the problem by three districts (Achinsk, Bol'shemurtinskiy and Kansk). The Achinsk and Kansk districts embrace large zones within which several industrial parks might be formed.

The basis for building production operations in almost all the districts of the region are the natural resources. But the industrial development of a number of districts might be governed by other factors as well, for example, convenient economic-geographic position. For instance, the role of the Tayshet district as a major transportation junction is explained by its location at the intersection of the Transsiberian and Baykal-Amur main rail lines. The Bol'shemurtinskiy, Balagansk and Tanguyskiy districts are close to industrially developed concentrations: Krasnoyarsk, Irkutsk and Bratsk, but the absence of a railroad is holding back their development.

Alternative Versions of Possible Location of New Production Operations in the Angara--Yenisey Region

	Ferrous Metallurgy				Nonferrous Metallurgy				
Districts	M	K	F	Mz	Al	STs	MN	TMG	MKh
Abalakovo		X	X	X		X	X	X	
Boguchany					X	X	X	X	X
Ust'-Ilimsk					X			X	X
Bratsk					X			X	X
Bol'shemurtinskiy							X	X	
Achinsk		X	X	X	X	X	X		
Kansk		X	X	X	X	X			
Tayshet	I	X	X	X	X				
Tanguyskiy				X				X	
Tulun				X					X
Balagansk									X
Cheremkhovo									
Sayanskiy		X	X	X	I		X		

	Chemical Industry				Machinebuilding				Timber and Lumber Industry	
Districts	NKh	EKhK	IV	RTI	ME	MC	MT	MP	LPK	TsBK
Abalakovo	X	X		X		X	X	X	I	
Boguchany	X	X		X					I	I

Districts	Chemical Industry				Machinebuilding				Timber and Lumber Industry	
	NKh	EKhK	IV	RTI	ME	MG	MT	MP	LPK	TsBK
Ust'-Ilimsk	X	X		X		X	X		I	I
Bratsk	X	X		X	X	X		X		
Bol'shemurtinskiy	X	X		X	X	X	X	X		
Achinsk				X	X	X	X	X		
Kansk		X	X	X	X	X	X	X		
Tayshet				X	X	X	X	X		
Tanguyskiy			X	X	X	X	X	X		
Tulun				X	X	X	X	X		
Balagansk			X	X	X	X	X	X		
Cheremkhovo				X	X	X	X	X		
Sayanskiy					I	X	I	X		

Note: X--taken under consideration as possible versions for location, I--assigned versions of location; M--metallurgical combine; other production operations bear the following symbols: K--quality steel, F--ferroalloys, Mz--steel products, Al--aluminum, STs--lead-zinc, MN--copper-nickel, TMG--titanium-magnesium, MKh--copper-chemical, NKh--petrochemical, EKhK--electrochemical, IV--synthetic fiber, RTI--industrial rubber goods; and in machinebuilding: ME--power engineering equipment, MG--mining equipment, MT--transportation equipment, MP--other types of machinebuilding, LPK--timber and lumber complex, TsBK--pulp and paper combine.

A certain reserve of labor resources is required to build and operate new production operations. An analysis of the information on this question has shown that many of these districts do not have their own labor resources. The possibility of attracting labor resources from outside the region was therefore envisaged as a condition of the problem. A number of conditions for attracting and holding population in the districts where the production projects would be concentrated were introduced into the problem for that purpose.

In the conditions of the problem the population is the consumer of the same resources as production (electric power, land and water). This is reflected in the respective indicators (standards) of specific rates of consumption per 1,000 inhabitants and in the costs of creating the necessary complex of facilities of the social infrastructure to "set up" (obustroystvo) the population. Moreover, to determine the total size of the population the number of workers employed in the enterprises under consideration in the sectors and industries constituting specialization was multiplied by 5 (the demographic coefficient). This coefficient reflects the number of people working in other industries and in the facilities of the infrastructure not specifically taken into account in the problem, and members of the population not part of the labor force.

The transportation network is represented by railroad sections, the directions and scale of transit traffic and the freight flows occurring between districts are given, and in the process of solution the additional load on sections resulting from the new freight flows that occur is determined. The solution reveals the need for development and reconstruction of existing sections of main line transportation or for construction of new railroads.

The region's power system was represented in the problem by 12 power junctions: Krasnoyarsk, Itatka, Kansk, Tayshet, Bratsk, Ust'-Ilimsk, Irkutsk, Tulun, Yeniseysk, Boguchany, and Sayanskiy. The West Siberian power junction was taken as external to the power system. A rather detailed examination of the power system was required for the Angara--Yenisey region. The reason for this is that Krasnoyarskiy Kray and Irkutskaya Oblast represent a large region in which the principal power generating capacities of the Siberian Unified Power System are being formed and there is also a wide variety of possible methods of covering the future shortage of electric power of the districts. The configuration of the network of power transmission lines, the flow of electric power and capacity was determined as a function of location of the new production operations and directions of electric power flows in the existing operating schedule of the Siberian Unified Electric Power System, taking into account its delivery outside the region and the needs of existing enterprises and those which are to be expanded.

An analysis of the results of solving the problem to determine the spatial structure of the economy of the Angara--Yenisey region showed that basically the production operations under consideration were concentrated in five districts: Kansk, Achinsk, Bratsk, Abalakovo and Tanguyskiy. Individual production projects are located in the other districts (Figure 1).

Production operations of ferrous metallurgy (the complete metallurgical cycle was given in the Tayshet district), the chemical industry and machinebuilding were located within the districts of Irkutskaya Oblast. The concentration of production operations in the Tanguyskiy district is sizable: synthetic fiber production and machinebuilding facilities (power engineering equipment and other forms of machinebuilding). Facilities for transportation equipment and power engineering equipment branches of machinebuilding are located in the Cheremkhovo district. Machinebuilding can also be regarded as an industry in which the Balagansk district would specialize. The Bratsk district proved to be favorable for location of chemical production operations: electrochemistry, plastics manufacturing, and industrial rubber goods. In the Ust'-Ilimsk district one of the industries comprising its specialization might be copper-chemical production (on the basis of Udokan copper). On the whole the scheme obtained for location of new production operations in the districts of Irkutskaya Oblast can be explained as follows. The Tayshet district has been planned in many scientific and project planning efforts of specific sectors and industries as a possible point for location of a major metallurgical combine, since it is located at the intersection of flows of coal and iron ore. The location of chemical production operations in the Tanguyskiy, Bratsk and Ust'-Ilimsk districts was dictated above all by the proximity to the sources of raw materials, by the availability of water resources (Angara River) and by the possibility of using the electric power of the Bratsk and Ust'-Ilimsk power junctions. Machinebuilding projects were located in the more inhabited portion of the region, which has certain labor resources and favorable conditions for the population to become established.

The most energy-intensive production operations of ferrous and nonferrous metallurgy and also of petrochemistry and machinebuilding were mainly located in the districts of Krasnoyarskiy Kray. The Achinsk district proved to be preferable for production of quality steel, and the Achinsk and Abalakovo (to equal degree) for production of ferroalloys, and two aluminum plants were located in the Achinsk and Kansk districts. The selection of these production operations was made under the influence of the power and transportation factors. Yet an analysis of the results of the solution showed that the local resources of the Achinsk district are on the margin. This was the reason for moving the new petrochemical production operation to the Abalakovo district. A number of production operations of nonferrous metallurgy--copper-nickel, lead-zinc, and titanium-magnesium, based on the processing of ores of nonferrous metals of deposits of Krasnoyarskiy Kray, will also be located there. Certain energy-intensive production operations and certain machinebuilding projects are proposed in the Sayan TPK on the basis of solution of the problem.

A version of operation of the region's Unified Power System was devised as a result of solving the problem. About 70 percent of the generation of electric power would be concentrated in two districts--Kansk and Achinsk. These districts supply more than 80 percent of the total power they produce to other power junctions in the region and outside it, more than 40 percent of it going to the West Siberian junction. The principal capacities for new power-intensive production operations have been located at power junctions generating large amounts of power. Their consumption of electric power was distributed as follows: Itatka 41 percent, Kansk 23 percent, Yeniseysk 15 percent, Bratsk 13 percent, i.e., four districts consume 92 percent of all the power necessary for new production operations and the population.

The territory of the Angara--Yenisey region can be divided into three zones: north (Abalakovo, Boguchany, Bratsk and Ust'-Ilimsk districts); central (Achinsk, Bol'shemurtinskiy, Kansk, Tanguyskiy and Tayshet districts); and south (Sayanskiy, Tulun, Balagansk and Cheremkhovo districts). As a result of solving the problem the northern zone proved to be preferable mostly for location of the production operations of the chemical industries (availability of large water resources, proximity of raw minerals); the central zone for location of the principal capacities of power-intensive and materials-intensive branches of ferrous and nonferrous metallurgy (production of base-load power at large GRES, existence of a developed transportation network); southern--for location of labor-intensive branches of machinebuilding (lower costs of building the infrastructure and attracting workers than in the central and northern zones).

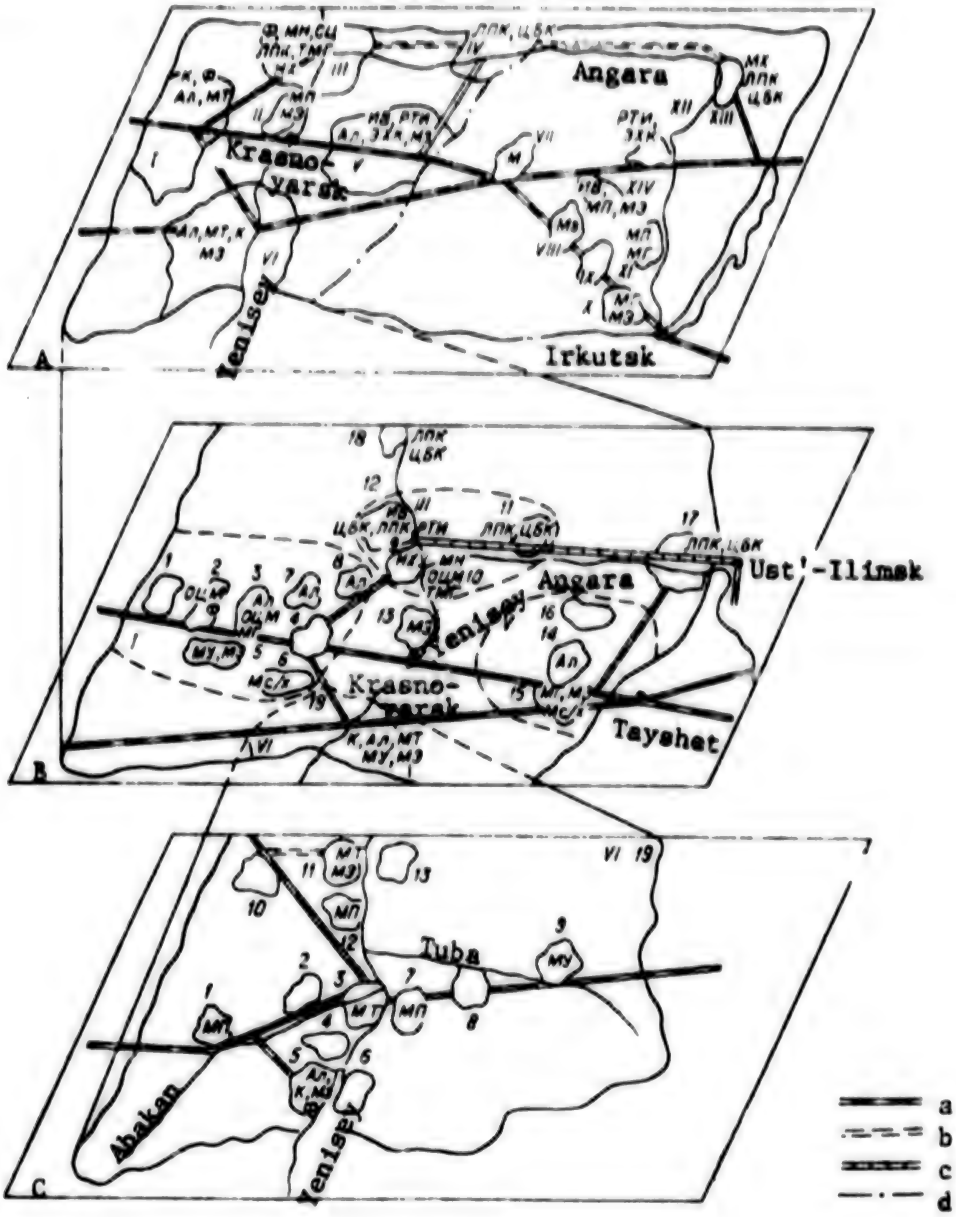

Figure 1. Production and spatial structure of the system of TPK's of the Angara--Yenisey region (results of the solution).

Note: The schemes of the alternative versions of the production and spatial structures obtained as the result of solving the problems for the Angara-Yenisey region (A), or Krasnoyarskiy Kray (B), and for the Sayan TPK (C).

Notes to Figure 1 (continued)

A) The districts of the Angara--Yeniaey region are as follows: I--Achinsk, II--Bol'shemurtinskiy, III--Abalakovo, IV--Boguchany, V--Kansk, VI--Sayanskiy, VII--Tayshet, VIII--Tulun, IX--Zima, X--Cheremkhovo, XI--Balagansk, XII--Bratsk, XIII--Ust'-Ilimsk, XIV--Tanguyskiy.

B) The districts of Krasnoyarskiy Kray are as follows: 1--Novaya Itatka, 2--Bogotol, 3--Kritovskiy, 4--Achinsk, 5--Sharypovskiy, 6--Uzhur, 7--Bol'sheuluyskiy, 8--Surikova, 9--Abalakovo, 10--Savinskiy, 11--Motygino, 12--Lesosibirsk, 13--Bol'shemurtinskiy, 14--Kansk, 15--Irbeyskiy, 16--Aban, 17--Boguchany, 18--Osinovka, 19--Sayanskiy.

C) The areas of the Sayan TPK are as follows: 1--Askiz, 2--Kirbinskaya, 3--Tashebinskaya (Abakan), 4--Luk'yanovskaya, 5--Oznachennoye (Sayanogorsk), 6--Shunerskaya, 7--Minusinsk, 8--Tesinskaya, 9--Kuragino, 10--Kop'yevo, 11--Terskiy, 12--Komsomol'skiy, 13--Krasnoturanskiy.

НХУ--petroleum-electro-coal chemical production, ОЦМ--plant for manufacturing products of nonferrous metals, МУ--production of manufactured fertilizers, П--plastics manufacturing plant, Мс/х--agricultural machinebuilding; the symbols for the other production operations have already been given in the table. Existing railroads (a); the version for building the railroad obtained by solving the problem (b); the version of building the railroad given as a condition of the problem (c); and the boundary between Krasnoyarskiy Kray and Irkutskaya Oblast (d).

The concentration of population involved in creating new industrial production operations, the capacities of construction camps, and the level of utilization of land and water resources would be as follows for the zone (in percentage):

Zone	Concentration of Population	Resource Utilization Land	Resource Utilization Water	Concentration of Capacities of Construction Camps
Southern	39	28	3	20
Central	40	42	51	44
Northern	21	30	46	36

When we analyze these data, we can draw the following conclusions:

1. The population related to creation of the industrial production operations was concentrated in the southern zone and along the Transsiberian Railroad, and only about 20 percent of the population is concentrated in the northern zone, where the costs of setting up the population are higher

(more expensive construction of housing and facilities of social and consumer services and more costly supply of the products of agriculture to the population).

2. Land resources in the southern and northern zones are given up to industrial construction and civil engineering in approximately equal proportions. This could be explained by the similarity of costs of developing them in these zones: average costs for the region increase in the northern districts because of northern cost-increase coefficients and in the southern regions because of additional outlays to pay compensation for farmland.

3. Water resources, which are practically unlimited in the northern districts, have attracted water-intensive industries there. Almost half of the water consumption of all the production operations and the population is concentrated in the northern districts, primarily in the Abalakovo district. At the same time base-load power would be the reason for locating water-intensive production operations in the central zone of the region as well, where the costs of supplying water to industry and the population are the highest (except for the Tanguyskiy district).

4. As a function of the version selected for location of new production operations the capacities of construction camps are mainly concentrated in the central and northern zones.

Thus the result of the solution of the problem of determining the spatial structure of the economy of the Angara--Yenisey region shows that the central zone could be more beneficial for location of new industrial production operations. As pointed out above, the reason for this is that in this zone the effect of the costs of developing local conditions levels out (as compared to the southern and northern zones) and there is a greater impact of the raw materials factor and shipment of finished products outside the region.

Calculations for the Angara--Yenisey region have shown that the following system of TPK's was defined within it: the Central Krasnoyarsk, the Sayan, the Lower Angara, the Bratsk--Ust'-Ilimsk, the Irkutsk--Cheremkhovo and the Noril'sk. These TPK's are at various levels of formation. For instance, for the Sayan TPK the question of formation of the spatial and production structure has been determined up to the year 1990, and there is no basis for supposing fundamental changes in the basic tendencies of its formation up to the year 2000. The same can be said of the Bratsk--Ust'-Ilimsk TPK. The Central Krasnoyarsk and Irkutsk--Cheremkhovo TPK's do not have such a definite spatial and production structure in the future. The Krasnoyarsk and Irkutsk industrial parks are considerably overloaded, a decision has not been made as to the definitive direction for development of the flanks of the Central Krasnoyarsk TPK and of industrial development of the region from Tayshet to Cheremkhovo, i.e., actually of the entire zone along the Transsiberian Railroad. Many questions concerning formation of the Lower Angara TPK and the Near North of Krasnoyarskiy Kray remain unresolved. The

Noril'sk Complex, the prospects for whose development are defined only by analyses done within sectors and industries, is taking shape in isolation.

TPK's of Krasnoyarskiy Kray

Solving the problem for the Angara--Yenisey region furnishes a conception of direction for further formation of the production structure of Krasnoyarskiy Kray as a whole and its individual parts. That is why the goal of solving the problem for Krasnoyarskiy Kray is to revise the version of the scheme for location of new production operations, to determine the basis for settlement in the kray, to furnish farm products and to achieve the intended standard of living of the population. The production operations that would be located in the districts of Krasnoyarskiy Kray on the basis of the results of solving the Angara--Yenisey problem were the basis for selection of the production operations of the sectors and industries comprising specialization. We made only slight additions.

The production infrastructure--transportation and the power system in this case--are not themselves subjects of the study, since the questions of their formation have already been determined in solving the problem for the Angara-Yenisey region, and it is assumed that in the stage of solving this problem the versions obtained for their formation and development will remain unchanged. The services of transportation and the power system are taken into account in the problem through indicators of costs for shipment of goods and for power supply.

Consideration was given to 19 districts in selecting versions of location of new industrial production operations in Krasnoyarskiy Kray. Within the Central Krasnoyarsk TPK there are 11 districts, in the Lower Angara 6, and the Sayan Complex represents a consolidated district (Terskiy), which provisionally includes the entire northern part of the TPK along the Yenisey, which is the most promising portion for the complex's future development. In view of the future intention to build the Osinovskaya GES, provision was made for the possibility of developing the Osinovskiy industrial park. This is important both in developing the Near North of Krasnoyarskiy Kray in general and also to preparing a springboard for developing the petroleum and gas province of the Central Siberian Plateau.

Taking districts of smaller size makes it possible to account more fully for the conditions of location, use of local resources, reserves of the production and social infrastructure and conditions for maintaining ecological balance. Whereas in the Angara-Yenisey problem land resources were differentiated by districts solely in terms of the costs of developing them, the constraints here are the amount of land, especially in those districts where there is productive farmland. Land categories were thus differentiated as a function of the pattern of future land use and also geological characteristics of its development.

Opportunities for water supply of production operations and the population and conditions for protecting water sources from harmful effluents were reflected in consideration of each district. The latter conditions include requirements of meeting standards of allowable concentrations in water sources within the district or along one river (in this case this mainly applies to the Chulym and Kan rivers).* The need to meet standards concerning maximum permissible concentration is a factor that greatly stands in the way of concentration of production operations which have harmful effluents.

In the problem of Krasnoyarskiy Kray, by contrast with the Angara--Yenisey problem, the attitude toward reserves of labor resources is more "strict." Whereas in the problem above the orientation was toward the possibility of unlimited attraction of labor resources from outside, here it was decided to use mainly internal resources in view of prospects for the growth of labor resources in the country. A reserve of manpower could occur thanks to natural population growth and redistribution of farm population thanks to intensification of agricultural production.

An attempt was made in the problem of Krasnoyarskiy Kray to take into account the population's need for farm products (data of the Economics Institute of the Siberian Department of VASKhNIL [All-Union Order of Lenin Academy of Agricultural Sciences imeni V. I. Lenin]). Agriculture was represented by two types: the agriculture taking shape in the southern, central and northern zones (its products could be transported over long distances), and suburban farming whose scale of development depends on the location of production operations by districts and the concentration of the population in them (its products are not transportable). All the indicators of unit costs and rates of consumption in agricultural production--land, water, labor, fuel and power, and so on--were charged to the production of one market basket of products. In order to take into account a certain reserve of labor resources becoming available to industry from agriculture, we studied two modes of production of agricultural products: extensive (labor-intensive, but less capital-intensive) and intensive (more capital-intensive, but making it possible to make a certain labor supply available).

Then the problem examined the conditions for redistribution of agricultural products among zones. This redistribution results from differing conditions for the operation and development of agriculture in the zones of Krasnoyarskiy Kray. The southern zone would be called upon to supply food not only to the population of the Sayan TPK, but also the population of the other regions in the kray. Agriculture is one of the leading sectors in which that complex specializes. The central zone is suitable for agriculture in its overall natural and climatic conditions, but there are a number of inhibiting factors for its intensive development. The northern zone is not very suitable in its natural and climatic conditions for development of agriculture on a large scale, and therefore development of industry in the Lower Angara TPK and the growth of the urban population require shipping in sizable amounts of farm products.

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* For sake of comparison we will give the average flow of waters at the points where the production operations would be located: 170-220 m^3/sec on the Chulym River, 100-280 on the Kan, 3,700-4,000 on the Angara and 8,600 m^3/sec on the Yenisey.

A series of computations in which particular conditions were varied made it possible to obtain a chart of the production and spatial structure of the system of TPK's of Krasnoyarskiy Kray over the future period taken under consideration. New production operations were located in 15 districts (see Figure 1).

It is proposed that the enterprises of ferrous and nonferrous metallurgy, the chemical industry and machinebuilding be located within 12 districts of the Central Krasnoyarsk TPK. On the basis of the results of solving the problem the districts that would develop in the western portion are Bogotol, Kritovskiy, Sharypovskiy, Uzhur, Bol'sheuluyskiy, and Bol'shemurtinskiy, and those of the eastern portion--Kansk and Irbeyskiy. Enterprises of power-intensive metallurgy and machinebuilding serving the KATEK [Kansk--Achinsk Fuel and Power Complex] were mainly located there. Production operations in the western portion of the complex would undergo the greatest development, since flows of raw materials and finished products gravitate basically toward the western border of the kray. The principal tendency in formation of the production structure of this part of the TPK is in line with the results of solving the Angara--Yenisey problem.

But, as already noted, the set of production operations to be located in the central region of Krasnoyarskiy Kray is very large and needs thorough additional analysis, especially since the commencement of construction of the KATEK is the basic factor in its development. Construction of the facilities of the KATEK itself--open-pit coal mines, GRES, enterprises making up the construction capability, and others--is putting a heavy load on the environment.

The major projects of the fuel and power industry have a strong impact on air, water and soil. For instance, the ecological balance could be upset by the following: 1) Emissions of harmful substances into the atmosphere. Whereas at present electrofilters are capturing ash at the thermal power plants, effective industrial equipment has not yet been devised to capture nitrogen oxide and sulfur. Construction of tall chimneys does not rescue the situation, but only makes it possible to scatter the harmful emissions over a sizable area. 2) Creation of man-made ponds--storage reservoirs (with feedback water supply) results in an appreciable rise in the humidity of the air because of the large area of evaporation, and the existence of the open-pit coal mines tends to drop the level of groundwater and even jeopardize the existence of certain streams. Industrial and sanitary sewage changes the natural regime of rivers and lakes, which results in a greater shortage of clean water in the watershed of the Chulym River. 3) Emissions and soluble effluents carried away by flows of air and water (sometimes over sizable distances) pollute the soil, poison the forests and detract from human living conditions.

In addition sizable land resources are taken out of economic use as industry develops: open-pit coal mines, waste pilings in the zone of GRES, reservoir ponds, and wide zones for sanitary protection. Moreover, a zone of green vegetation many times larger than the complex itself is required to regenerate the air. At the same time the importance of land resources in this portion of Krasnoyarskiy Kray cannot be overlooked in connection with the future growth of agricultural production to supply food to the population of the Angara--Yenisey region.

The principal production operations with a claim to location in the western portion of the Central Krasnoyarsk TPK will be the following: 1) facilities of the KATEK; 2) a restricted number of large energy-intensive production operations directly related to consumption of the KATEK's electric power; 3) production operations necessary for the functioning of the KATEK--labor-intensive machinebuilding enterprises manufacturing equipment for coal mines and GRES (mainly small equipment), and the enterprises of the construction capability. The eastern portion of the Central Krasnoyarsk TPK (in the Angara--Yenisey problem--the Kansk district) was somewhat overloaded with production operations requiring a sizable amount of water and land resources on the basis of the results of the previous problem. Introduction of revised figures on environmental protection (meeting the standards for the maximum permissible concentration in the Kan River) and differentiated valuation of land resources from the standpoint of their agricultural significance made it possible to relieve this portion of the Central Krasnoyarsk TPK of the synthetic fiber and industrial rubber products operations. On the basis of the results of solving the Krasnoyarskiy Kray problem the aluminum production operation (the principal factor in its location is also electric power--proximity to the GRES of the eastern wing of the KATEK) is located in this zone along with the operations for production of mining and agricultural machines.

The northern portion of this complex--the left bank of the Yenisey--constitutes a reserve for future development. There the Bol'shemurtinskiy district is most favorable for location of industrial production operations. But since the district is in a zone of highly productive farmland, there were "strictly" limited opportunities for use of land resources for industrial development. The production operations for manufacturing mining, transportation and agricultural equipment were located in this district. The production structure obtained for the Bol'shemurtinskiy district does not contradict the results of solving the Angara--Yenisey problem--the tendency is the same: above all take the load off the Krasnoyarsk industrial park and establish close cooperation with it.

In the more remote future development of the productive forces of the kray will rely above all on the Lower Angara Valley. As for the infrastructure and above all development of the transportation system of this region, large industrial parks will be formed there on the basis of various industries, mainly nonferrous metallurgy, the chemical industry and the timber and lumber industry.

In this problem the Sayan TPK is regarded above all from the standpoint of supplying food to the population of the other complexes. The results of the solution showed that the agriculture of the Sayan TPK, assuming that it fully supplies its own population with agricultural products, will be able to furnish 30 percent of the food to the population of the Central Krasnoyarsk TPK and 55 percent of that for the population of the Lower Angara TPK.

The Sayan TPK

The need to study problems related to formation of the Sayan TPK results from its place in the process of intensive development of the natural resources of the Angara--Yenisey region. The creation of this complex is urgent because of many interrelated factors. They are the favorable natural and climatic conditions for human life and for large-scale development of agriculture, an economic-geographic position convenient for accomplishing production connections with other TPK's in Siberia, a high degree of economic development by Siberian standards, and the availability of areas for location of new production operations and settlement.

The first stage of the complex's formation is now taking place (9th and 10th five-year plans). The scheme for location of the priority production operations of the sectors and industries comprising the complex's specialization has been determined. Large enterprises for manufacturing transportation equipment and power machines and enterprises of light industry and the food industry have been built or are being built at Abakan, Chernogorsk and Minusinsk. As a result two large industrial parks are taking shape: the Abakan--Chernogorsk and the Minusinsk. In the southern portion of the Sayan TPK a third industrial park--the Sayanogorsk--has come under construction. It includes the Sayano-Shushenskaya GES, an aluminum plant, and a number of enterprises for production of building materials, all under construction.

The second stage of formation of the Sayan TPK up to the year 2000 was studied in the problem of optimalizing the production and spatial structures of TPK's.* The makeup of the production operations of the industries and sectors comprising the specialization of the Sayan TPK was determined for this problem as a result of optimalization of the spatial structure of the economy of Krasnoyarskiy Kray. Among the facilities of the production operations rounding out the complex it was assumed that a TETs could be built.

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* For more detail see Malinovskaya, M. A., "Variant Computations of the Spatial Structure of the Sayan TPK," IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK, (Issue No 1), No 1, 1979, pp 40-48.

The posing of the problem makes provision for establishing broad external connections between the complexes and Siberia's other TPK's with respect to deliveries of raw materials, transmission of electric power from the Siberian Unified Electric Power System, and so on.

The intracomplex transport and power networks are regarded as independent subjects for modeling. Other facilities making up the infrastructure are taken into account through indicators of the costs of developing the areas for industrial construction and civil engineering and for use and regulation of water sources. By contrast with the previous problems, in examining the Sayan Complex we took into account conditions for use of local resources of the specific construction areas suitable for industrial construction and civil engineering projects.

Local resources are regarded in the problem as independent subjects of study. All the areas of the Sayan TPK were evaluated from the standpoint of their suitability for agriculture, their supply of water resources, the infrastructure within the concentration, location relative to existing sources of raw materials, transportation routes and utility facilities of the infrastructure common to the entire complex.

Solving the problem for the Sayan TPK showed that of the 12 areas considered 7 have priority; formation of industrial parks differing in size and production structure was outlined in each of them. The most favorable for location of production operations turned out to be the central portion of the Sayan TPK, which is located in the zone of gravitation toward the complex's transportation network, which is already taking place, toward the Yenisey as an unlimited source of water, and toward the existing industrial parks and the Sayano-Shushenskaya GES. Energy-intensive production operations were located in the Sayanogorsk industrial park, and labor-intensive production operations in the Abakan--Chernogorsk and Minusinsk industrial parks. Moreover, on the basis of the results of solution in the second stage of creation of the Sayan TPK it is possible to form the Kuragino and Askiz industrial parks and to develop industry in its northern portion, where there are a number of favorable areas (Terskiy, Komsomol'skiy, etc.). On the basis of the results of solution of the problem machinebuilding plants are located in the northern portion of the Sayan Complex, and on the basis of the individual variants of the solution--the enterprises of nonferrous metallurgy were also located there (this was favored by the proximity of the northern portion of the TPK to the future power stations of the KATEK).

After the first stage of creation of the Minusinsk industrial park there will be room left for further development. But that reserve space is limited and is holding back the development here of production operations with harmful effluents, since the most productive farmland is located very close to Minusinsk. That is why further development of industrial parks is possible only by adding production operations that do not require large construction sites and have no impact on the environment. According to the results of solving the problem in the future the Minusinsk industrial park could develop with new machinebuilding production operations.

The Sayanogorsk industrial park has also begun to take shape, and its reserves are very large. That is why in the second phase of development it will be attractive for location of new large-scale production operations. According to the results of the solution new facilities for production of aluminum and rolled products are located here.

Project planning analyses call for creation of an electrometallurgical complex (VSEMK) in the Tesinskaya area. The principal arguments for this proposal were the cheap electric power of the Sayano-Shushenskaya GES and the adequacy of transportation. But it must be borne in mind that the area is located in the zone of most productive farmland. Moreover, it turned out that the GES will not be able to furnish electric power for such a large production operation, which requires about 22 billion kilowatt-hours (leaving only about 6 billion kilowatt-hours in the complex after electric power has been transmitted to the Kuzbass), the conditions for construction of the area are not favorable enough, and the flow of the Tuba River does not cover the combine's water consumption. In this problem it was decided to look at other areas for location of the VSEMK. As a result of the solution it was located in the Sayanogorsk park. But this is by no means the best choice for location of the VSEMK. Creation of a large-scale industrial park at that point (where nonferrous metallurgy and machinebuilding are already developing) will involve the development of a large city as well, and for that there are certain inhibiting factors, in particular the microclimatic and soil conditions.

Development of the Abakan--Chernogorsk and Minusinsk industrial parks could in the more remote future result in their merger and transformation into a large-scale industrial agglomeration, which has its bad side (the problem of urbanization of large cities). In certain versions of the computations, then, conditions were introduced calling for "limitation of the population" of those parks. In this case new production operations are located in the north of the Sayan TPK. Consequently, the northern portion of the Sayan TPK, where there are a number of suitable areas, becomes attractive in future for development of the complex, though it does not have transportation facilities.

The Kuragino industrial park could be formed by building enterprises for production of phosphorus and complete fertilizers, which are so needed, above all by the agriculture of the Sayan TPK. The formation of the Askiz industrial park was also outlined; a portion of the enterprises of ferrous metallurgy, the chemical industry and the lumber industry would be located there.

In the second stage of development of the Sayan TPK the industrial sector would extend not only over its central portion (the nucleus of the complex) but also to its flanks. The industrial parks now under construction would continue their development; the largest of them are the Abakan--Chernogorsk and the Sayanogorsk. These industrial parks will consume approximately 90 percent of the electric power and heat making up the complex's total requirement. The highest concentration of population (approximately 70 percent of the complex's total population) will be in the industrial parks which are now being built. But the results of solving the problem showed that the second phase of creation of the Sayan TPK mainly uses the reserves of those industrial parks, especially the Abakan--Chernogorsk and Minusinsk, and there will be an objective need for industrial development of its flanks. Moreover, the northern portion of the complex will become the most promising. The southern and especially the right-bank portion of the Sayan TPK should become a zone for highly developed agricultural production, and a particularly restrained attitude needs to be taken toward location of industrial enterprises there. On the whole the Sayan TPK does not exhaust the reserves for its development even beyond the year 2000. But even now there is a need to work out the directions of its development.

The Lower Angara TPK

As shown by an analysis of the prospects for development of the Sayan and Central Krasnoyarsk TPK's, the concentration of industrial production in them results in a gradual growth of the shortage, first, of water resources and then of land resources as well. It has become necessary even now, then, to justify strategies for the development and growth of the northern regions of Krasnoyarskiy Kray. The Lower Angara Valley, with its natural resources, raw materials and local resources (on a substantial scale), with its convenient location between the northern regions of the kray, which are rich in minerals, and the southern regions with their fuel and power resources, could become a most important reserve region for future development of the kray's productive forces. It has sufficiently favorable conditions for location of large-scale production operations in a number of industries requiring a large amount of water, land, power and raw materials.

The Lower Angara Valley has undergone little economic development at the present time because of the problematical natural and climatic conditions, it has low population density, and it does not withstand the competition of the Central Krasnoyarsk and Sayan TPK's for the location of certain production operations. But this ought not to become decisive to its future economic development.

Industrial development of the Lower Angara TPK will depend on solving a number of fundamental problems. First of all, selection of the site (alignment and elevation) of the Sredne-Yeniseyskaya GES, which involves the need of developing the Gorevskoye lead and zinc deposit. The hydrological conditions for developing this deposit are problematical because a large portion of the ore body is located under the bed of the Angara River. Gidroproyekt imeni S. A. Zhuk [All-Union Planning, Surveying and Scientific Research Institute of Hydraulic Engineering] has worked out a series of alternative versions of construction of the Sredne-Yeniseyskaya GES which provide for comprehensive solution of the problems of power engineering and protecting the deposit from surface and groundwater. Recent work done by this institute favors the version which would reduce the elevation of the Sredne-Yeniseyskaya GES. Work to prepare the alternative versions of the design for construction of the GES has a history that goes back many years, and the dates for building the GES and the Gorevskiy Mining and Ore Dressing Combine are being postponed constantly. Construction time could be shortened substantially if commencement of construction of the GES were linked to the date for completion of construction of the Sayano-Shushenskaya GES, since in that case it would be possible to transfer a part of the crew of construction workers and specialized equipment to the Angara Valley region. As shown by the experience of Bratskgesstroy, this will make it possible to save several years.

Second, the route of the meridional railroad to Noril'sk needs to be chosen. Project planning institutes are offering several alternative directions for this route, among which the principal ones are the Yenisey, the Surgut and the Salekhard. Each of the possible directions will promote economic development of the region through which the route passes. The Yenisey alternative of the railroad, which could run along the right bank of the Yenisey, is preferable for development of the northern regions of Krasnoyarskiy Kray.

Third, determination of the route of the Northern Siberian Railroad in the section between Abalakovo and the Boguchanskaya GES. Project planning institutes propose two possible routes: a right-bank and a left-bank. The difference in distance and costs is negligible. But the right-bank alternative is preferable for development of the productive forces of the Angara Valley in Krasnoyarskiy Kray, since in this case the railroad will pass close to deposits of ores of ferrous and nonferrous metals and possible oil fields.

Fourth, a study of the methods of bringing the ore deposits of the Angara-Pit basin under exploitation. The largest prospected deposit of this basin is the Nizhneangarskoye. Utilization of the ores is complicated because they contain a high percentage of silicon, which makes them difficult to dress. But full-scale tests have shown the possibility of direct reduction of the iron from these ores. Kansk-Achinsk coals were used as the reducing agent. Joint use of the hematite ores of the Angara-Pit basin and the magnetite ores of the Tagarskoye deposit is also effective.

Fifth, prospects of the Central Siberian springboard for the country's new source of petroleum production are unclear. It is assumed that we can expect petroleum reserves to be discovered here. At the same time this region has not been sufficiently studied. It is difficult to study because the presumed reserves of petroleum are scattered over several petroleum provinces and the deposits are not concentrated in any one field, as was the case in Western Siberia. The principal petroleum and gas provinces are located in regions with problematical natural and climatic conditions, and the petroleum lies at a considerable depth. This detracts from the technical-and-economic indicators of production as compared to the Middle Ob'. Time is still needed to confirm the forecast estimate of the reserves.

Additional scientific and project planning work is needed to solve a large portion of these problems. There are grounds nevertheless to describe the Lower Angara Valley as a potential region for future development of the productive forces of Krasnoyarskiy Kray and the Angara--Yenisey region as a whole.

When we pose the problem of optimalizing the production and spatial structures of the Lower Angara TPK we assume that a rail outlet would be built from the Noril'sk region to the Angara Valley and that construction of the railroad from Ust'-Ilimsk to Abalakovo via Boguchany would be completed. In addition, certain other suppositions were made. Power engineering facilities (GES, GRES, TETs), energy-intensive and materials-intensive production operations in nonferrous and ferrous metallurgy and the timber and chemical industries were among the production operations under consideration for the Lower Angara TPK. They are all based largely on the resources of raw materials of the Angara Valley or the northern regions of Krasnoyarskiy Kray (including Noril'sk). As a rule these production operations occupy sizable areas for construction when we take into account creation of large zones for sanitary protection and they require large volumes of water.

But only the question of locating production operations for thorough processing of wood in the Angara Valley in Krasnoyarskiy Kray has been studied in detail. Inclusion of the other production operations in the TPK needs additional justification. For example, the possibility of separating certain GRES from the KATEK and attaching them to the Lower Angara TPK. This would help to preserve the ecological balance in the western portion of the Central Krasnoyarsk TPK. The problem examined the possibility of building a pipeline to transport water-coal mixtures of brown coals of the Kansk-Achinsk basin over a distance of 300 km. The coal pipelines have a sufficient carrying capacity, the process of operation can be entirely automated, and they are built more rapidly than railroads. Research conducted in our country and abroad has confirmed that pipelines for coal transport are very promising.*

Building large generating facilities in the Lower Angara Valley makes it possible to think of locating power-intensive production operations here. It was assumed in the problem that the growth of the country's need for ferrous and nonferrous metals and chemical products would evidently be better provided for by building power-intensive production operations at the site where large amounts of power are being generated. What is more, in future there is already a plan to transmit sizable amounts of power to cover the shortage of electric power in the regions of the Urals and Kazakhstan.

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* Bokserman, Yu., "On Progressive New Types of Transport," PLANOVOYE KHOZYAYSTVO, No 11, 1978.

The problem assumed that petroleum would be produced in certain parts of the Central Siberian Plateau. It was moreover assumed that under the extreme conditions of the northern parts of the kray it would not be feasible to build permanent settlements at each of the deposits being exploited. Relying on the experience of the organization of work under conditions in the north of Western Siberia, the problem assumed the tour-of-duty method of organizing the work, in which the region of the Lower Angara TPK, where the principal technical base for support of the oil fields and a sizable portion of the population involved in developing and operating the deposit can be located, would be the supporting base for development of the petroleum and gas province.

The petroleum of the Central Siberian Plateau, the salts of the Kanarayskoye deposit, the brown coal of the Kansk-Achinsk basin--these are components for building large-scale production operations of the chemical industry in the Lower Angara TPK. It is assumed that raw materials would be transported by pipeline to the location of petrochemical, electrochemical or coal-chemical production operations.

Formation of the Lower Angara TPK is closely bound up with development of the regions of the western and eastern parts of the Central Krasnoyarsk TPK (the Achinsk and Kansk districts in the problem). For many enterprises whose location was taken up in the problem these districts are more favorable with respect to a number of technical-and-economic indicators, and the Angara Valley cannot compete with them. Only the substantial constraints on use of local resources in the districts of the Central Krasnoyarsk TPK determine the production and spatial structure of the Lower Angara TPK (Figure 2).

On the basis of the results of solving the problem the promising sectors and industries in the western part (near the Yenisey) of the TPK--the Lesosibirsk district--are electric power, power-intensive production operations of nonferrous metallurgy (aluminum and the manufacturing of nonferrous metals), chemical enterprises (coal chemistry and petrochemistry), and also timber and lumber. The portion near the Yenisey has advantages over the eastern part of the TPK (the Boguchany district) in that even now transport is possible by rail in the southern direction and along the Yenisey in the northern direction. Moreover, the natural conditions for people to live are more favorable in the Lesosibirsk district than in the eastern part, and it is also easier to build up the source of food.

Industrial development of the eastern part has already begun: the Boguchanskaya GES is under construction. But the question of the sectoral structure of the Boguchany district has not been definitively resolved. There are only certain project planning efforts concerning location of production operations of nonferrous metallurgy and sawmill operation. For that reason the problem also took up a version calling for possible location in the Boguchany district of a number of production operations of nonferrous and ferrous metallurgy, the chemical industries and GRES. On the basis of the solution power-intensive production operations of ferrous and nonferrous metallurgy, GRES, lumber mills and pulp and paper combines could develop here. We should note that the natural and climatic conditions here are more harsh than in the western part of the TPK. This restricts opportunities for developing agriculture on the scale necessary to supply the basic foodstuffs to the population. Large amounts of farm products would have to be brought in from the central and southern parts of the kray, and local hothouse growing would have to be intensively developed. In the Boguchany district the transportation conditions are also more problematical. Even after completion of construction of the rail line from Reshoty to Boguchany it would still be necessary to establish reliable connections with the Bratsk--Ust'-Ilimsk TPK, i.e., the section from Ust'-Ilimsk to Boguchany would have to be built.

The solution showed that whereas prospects for development of the productive forces of the extreme subregions of the future Lower Angara TPK are to some degree clear, the question of developing the central part of the Angara Valley (Motygino district) has received practically no treatment in project planning work. Development of this part of the TPK depends wholly on construction of the Northern Siberian Railroad, which must be regarded as a main transit line connecting the regions of the west with the Far East and giving the BAM another outlet to the west. The importance of this region will grow even more if the road is built northward on the right bank of the Yenisey. It would then be possible to create a large-scale Motygino industrial park, which would take over a portion of the production operations of the Lesosibirsk and Boguchany parks. From the results of solving the problem (assuming that the Northern Siberian Railroad exists) large power-intensive production operations of nonferrous metallurgy, the chemical industry, etc., would be located in the Motygino district.

In the Lower Angara Valley provision is made for location of several sawmill and pulp and paper enterprises. But it is questionable on the other hand whether the resources of local raw materials would be adequate for the proposed development of the wood processing industries and on the other whether the necessary quality of water of the Angara could be maintained after large-scale enterprises of the chemical industry and nonferrous metallurgy were built on it. This forces us to the conclusion that it obviously would be advisable in the Lower Angara Valley to confine ourselves to building the Boguchany timber and lumber combine and pulp and paper combine on the Angara River. Further along the course of this river in the Motygino district, and even more in the Lesosibirsk district, water resources may not be of such quality as to meet such an exacting production operation as pulp and paper production. We should bear in mind that the harshness of the climate slows down biological processes and reduces the ability of bodies of water to purify themselves. Moreover, after reservoirs are created, the ability of bodies of water to purify themselves will become still less because of the reduced rate of flow.

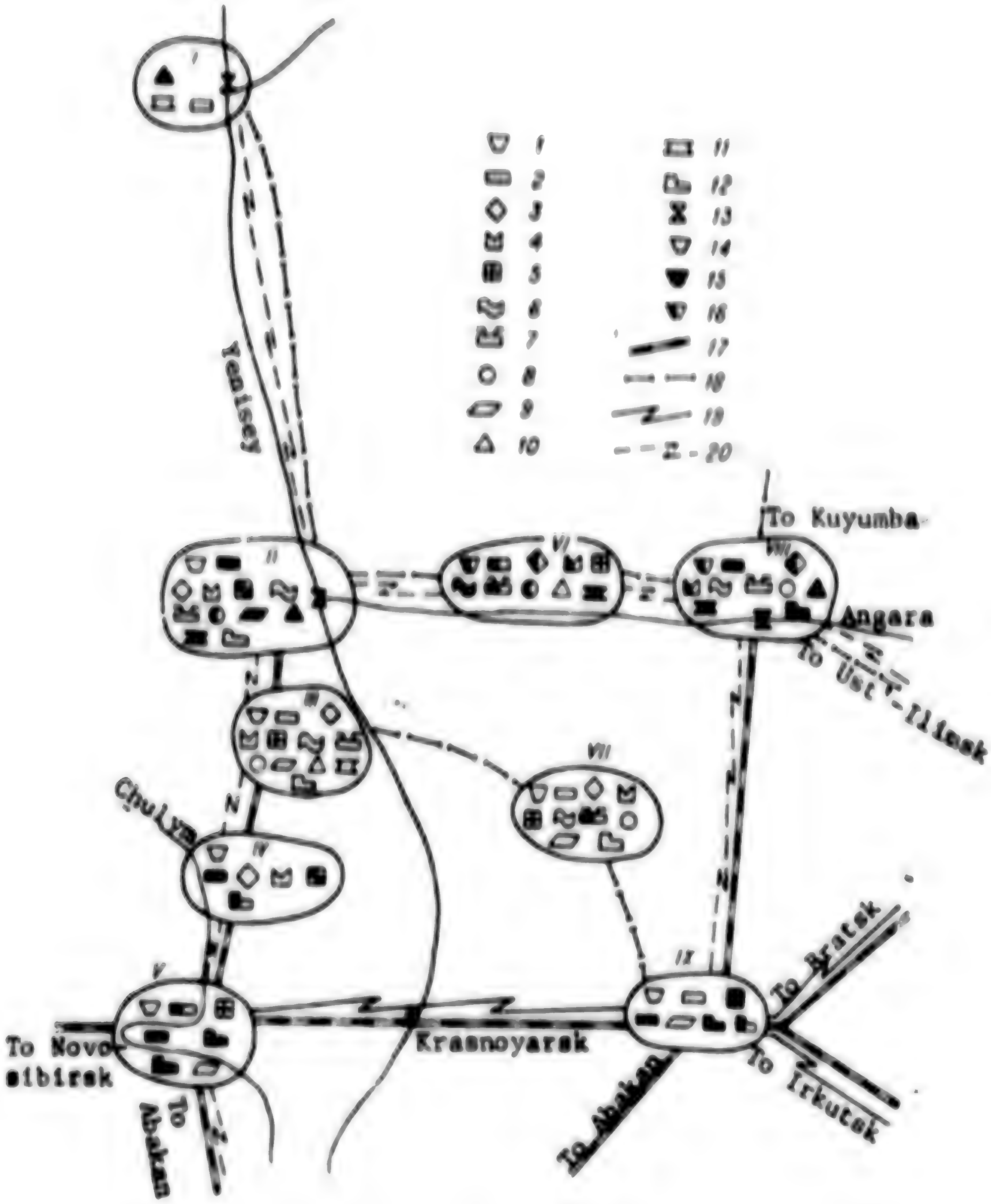

Figure 2. Location of new production operations (on the basis of the results of solving the problem).

Districts: I--Osinovskiy, II--Lesosibirsk, III--Savinskiy, IV--Surikova, V--Achinsk, VI--Motygino, VII--Taseyevskiy, VIII--Boguchany, IX--Kansk. Production operations: 1--ferroalloys, 2--aluminum, 3--lead and zinc, 4--copper and nickel, 5--nonferrous metal manufacturing, 6--synthetic fiber, 7--electrochemical, 8--petrochemical, 9--coal chemical, 10--timber and lumber complex, 11--pulp and paper combine, 12--GRES, 13--GES, 14--variant studied, 15--definite variant, 16--possible variant. Railroads: 17--existing, 18--proposed by the authors. Long-distance power transmission lines (≥500 MW): 19--existing, 20--proposed.

Development of the hydropower resources of the Yenisey River will continue in the future. The problem considered the possibility of forming the Osinovskiy industrial park on the basis of the Osinovskaya GES. This park could be regarded as the next stage in the further progress of the productive forces into the northern parts of the Angara--Yenisey region.

Thus the studies made confirmed the possibility of successive solution of the series of mathematical-economic problems of optimalizing the spatial structure of the economy of the Angara--Yenisey region and of its parts. Each problem is organically related to solution of the previous one and subsequent one in the respective hierarchy of the TPS (the region, the oblast or kray, the TPK, the industrial park). Joint consideration of all elements of the economy within the TPS makes it possible to make a quantitative evaluation of alternative versions for location of the productive forces and of utilization of local resources.

BOGUCHANY SUBREGION OF THE ANGARA VALLEY IN KRASNOYARSKIY KRAY

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 95-98

[Paper by V. P. Gukov]

[Text] Until recently economic developments in the regions of the Angara Valley in Krasnoyarskiy Kray were viewed from the standpoint of building a unified economic complex there whose formation would go from west to east. It was assumed that building the highly economical Yeniseyskaya GES below the mouth of the Angara would not only furnish the Lower Angara Valley an abundance of electric power, which would make it possible to develop power-intensive production operations there intensively, but also to greatly improve the conditions of navigation on the Angara and Yenisey thanks to creation of a deep reservoir. Such an improvement would make it easier to develop the natural resources of the Lower Angara Valley. After construction of the Yeniseyskaya GES the production capability for capital construction and the crew of construction workers could build the enterprises which would be the consumers of the electric power, and after that they would go on to build the Boguchanskaya GES. At that time the question of the site for building the Boguchanskaya GES had not yet been definitively resolved between the Kodinsk and Murskiy sites (stvory). The basic economic potential was to be located in the western portion of the Angara Valley in Krasnoyarskiy Kray. The industrial parks and centers to be created there would be linked to one another by the Northern Siberian Railroad.*

The actual course of economic development has been somewhat different. The discovery in the early sixties of a polymetallic deposit in the bed of the Angara not far from its mouth long held back resolution of the question of building the Yeniseyskaya GES. Both the dates and directions of the route of the Northern Siberian Railroad remain unclear. In that time there have been substantial changes in the level of preparedness for development of the natural resources of the Angara Valley in Krasnoyarskiy Kray. Whereas previously its western parts were accessible from the standpoint of transportation, now the situation with the eastern parts has changed considerably for the better. The railroad between Reshoty and Boguchany, now under construction, has come close to them. There remain 45 km to build from the settlement Karabula to the bank of the Angara. Navigation with shallow-draft vessels in the section from Ust'-Ilimsk to Kezhma, which previously was not used, was organized back when the Ust'-Ilimskaya GES was being built.

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* Bandman, M. K., "Krasnoyarskoye Priangar'ye" [The Angara Valley in Krasnoyarskiy Kray], Novosibirsk, Kn. izd-vo, 1962.

At the same time there still has been no definite answer about the site and elevation of the storage reservoir of the Yeniseyskaya GES, so that sites cannot be chosen for the industrial zones and zones of settlement on the banks of the future Yenisey Reservoir. But the site of the Boguchanskaya GES has been determined--the Kodinsk site, the easternmost of those under consideration, and a design has already been made for this hydroelectric power station. The Bratsk--Ust'-Ilimsk TPK, which possesses a strong construction and power capability and experienced personnel has come quite close to the eastern regions. In the western regions a large-scale construction capability has not been built up in the time which has passed, and this is holding back development there of enterprises in wood chemistry and the cellulose industry, for which there is an acute need because of the concentration in Lesosibirsk of sawmill and woodworking capacities which use only high-grade timber and yield a sizable amount of waste and scrap. Preparatory work for construction of the Boguchanskaya GES has been under way for several years now: the pioneer settlement has been built, construction of the power transmission line from Sedanovo to the site is nearing completion, the winter road from Sedanovo to the site has been in service for several years, and a highway is being built parallel to it.

Geological prospecting has in recent years established favorable preconditions for exploration of petroleum and gas deposits in the basin of the Podkamennaya Tunguska River; their development would be best accomplished from the Angara Valley.* A flow of oil was obtained from an exploratory well in the Sobinskoye uplift of the Katangskaya anteclise. We should take into account that this region is very close to areas which are relatively accessible from the standpoint of transportation. From the city of Ust'-Ilimsk, the rail terminus, to the settlement of Kezhma, located on the Angara, is 165 km by river. From Kezhma to the Sobinskoye uplift is only about 150 km by the winter road. Other alternatives of transportation connections in this region are more expensive or not very reliable. The carrying of cargo on the Podkamennaya Tunguska is limited both by the depth and also by the brevity of the period when the water is high. Advancement of supplies by airplane or helicopter would be very expensive, since a large amount of freight is required for petroleum and gas exploration.

Given these conditions there is a need, in our opinion, to change the approach to development of the natural resources of the Angara Valley in

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* Grebenyuk, V. V., et al., "Main Directions of Geological Prospecting for Petroleum and Gas in Krasnoyarskiy Kray in the Final Years of the 10th Five-Year Plan," GEOLOGIYA NEFTI I GAZA, No 12, 1978, pp 25-31.

Krasnoyarskiy Kray both in direction and also time frame: there is now a need to look upon this region not as a unified whole, but as two subregions which are fairly separate, at least in the first stage: the eastern--Boguchany and the western--the Middle Yenisey. Development of the Middle Yenisey subregion necessitates further development of the natural resources of the Yenisey basin, hydropower resources above all. In the area of the mouth of the Angara a very large sawmill center has been built. Capacities of the cellulose industry and wood chemistry are needed here to utilize the scrap and waste from the sawmills and timber operations. At a short distance from the Yenisey is the Yenisey Ridge, which is abundant in a variety of mineral resources. A GES could be built below the mouth of the Angara.

The Boguchany subregion is the next stage in economic development of the Angara Valley and the springboard for bringing under exploitation the natural resources, above all petroleum and gas, of the upper reaches of the Podkammenaya Tunguska. Its specialization in the first stage would be determined by cheap electric power and high-grade timber resources. It would be wise to develop the economy here by relying on the Bratsk--Ust'-Ilimsk TPK, which is located nearby. A large construction and building materials industry has been built in the TPK, there is an electric power capability, and much experience has been acquired in organizing and performing the work of developing hydropower and timber resources. The areas located south of the Boguchany subregion do not have a construction or building materials base at the present time, nor experience in large-scale development. They have even seen an outflow of population in recent years and a slower pace of capital construction.

In connection with commencement of preparatory work for construction of the Boguchanskaya GES the question of lines of economic development and the order in which resources are to be developed is becoming very acute. The lack of a hypothesis for development of the Boguchany subregion provided with sufficient scientific substantiation results in implementation of purely departmental solutions which do not take into account the advisability and effectiveness of building here a complex of interrelated production operations. It is quite obvious that railroads and power transmission lines should lead the way in their pace of construction. But at present they are not even being designed. Since the dam of the Boguchanskaya GES is to be stone-rubble, its erection means hauling a relatively small amount of freight, and the builders of the hydraulic engineering structure justify the efficiency of building the hydroelectric power station even if a railroad is not built to the site. One might agree with this if there were no need to bring under exploitation the timber and eventually mineral resources. They cannot be developed without a railroad. In this situation extending the date for construction of the railroad to the site only causes an indubitable rise in the cost to the national economy. Because there is no power transmission line enterprises located in that area receive electric power from independent diesel power plants. The process of infrastructural preparation of development is proceeding very inefficiently because it is being conducted by a variety of different departments. A strong production capability for capital construction has not yet been built up, there are no cheap and reliable main transportation routes, and power transmission lines are lacking.

Selection of the correct system for regional organization of the economy and the system of settlement, and the order and phases of their progress in time plays an important role in saving on development costs and ultimately on the operating costs of the complex to be built. Departmental divergence among timber and lumber operations, wood-chemical facilities and sovkhozes in settling the general questions of developing the area has had the result that every enterprise builds its own settlement and its own subsidiary and auxiliary production facilities.

We will attempt to portray the general outlines and possible stages of economic development of the Boguchany subregion. The leading role will be played by the Kodinsk industrial park. Hydropower and timber resources will be the basis of its formation. The average output of electric power over a number of years is 17.8 billion kilowatt-hours per year. The capacity of timber and lumber operations, on the basis of the size of the source of the raw material, is estimated at 6-7 million cubic meters of timber. In addition to these facilities mining and ore dressing combines for enrichment of raw minerals, iron ores above all, could be enterprises representing industries in which the park would specialize. Construction of the railroad from Karabula station to the site of the hydropower complex needs to be speeded up if this park is to take shape successfully.

The structure of the Yarki industrial park will be determined by timbering enterprises and enterprises for thorough mechanical and chemical processing of wood. In the first stage of its formation sawmills and the lumber transshipment yard should be built.

The Kezhma industrial center will be formed as the center of logging operations. In addition facilities need to be built here for transshipment of cargo going to supply the upper reaches of the Podkammenaya Tunguska. The structure of the Chadobetskiy industrial center is determined by enterprises for the mining and enrichment of minerals. The Karabula and Chunoyarskiy industrial centers are already being formed around existing railroad stations between Reshoty and Karabula. Capacities not only for logging but also for sawmilling and railroad tie sawing, manufacturing of wood laminate and wood for containers are scheduled for construction in them. Because of the limited capabilities of construction organizations at present capacities for processing the timber are being built very slowly. Almost all the timber cut is shipped out in the log, and the waste from timber operations is not being utilized.

Several industrial points are operating in the valley of the Angara. Logging operations determined their specialization. They obtain all their timber by raft. The industrial points Bolturino, Novaya Nedokura, Selenginskiy, Priangarskiy and Tagara are in the zone to be flooded by the

Boguchanskaya GES and will be moved. Taking into account the enterprises to be built at Kodinsk for thorough mechanical and chemical processing of wood, it is advisable to ship the timber from all these industrial points in the full-length log and to organize utilization of the waste from logging operations. At industrial points located below the site of the Boguchanskaya GES, once the foundation elevation of the Sredne-Yeniseyskaya GES has been established, construction of capacities for shipping timber in the log to the Yarki industrial park will also have to begin. Moreover, utilization of the waste of logging operations should also be organized there.

Agricultural production should be conducted with maximum development of capacities for production of farm products on an industrial basis. Moreover, it will be possible to build a sizable portion of them within the industrial parks and industrial centers.

The economic development of the Boguchany subregion should be carried out in stages. The Kodinsk industrial park, the Karabula, Chunoyarskiy, Kezhma and Yarki industrial centers, and industrial points on the bank of the Boguchany reservoir will take shape first of all. It is important to successful performance of this stage that construction be speeded up on the railroad from Karabula station to the mouth of the Karabula River, the settlement of Yarki and then along the right bank to the site of the Boguchanskaya GES. In that same period the network of power transmission lines should be built and a winter road cleared from Kezhma to Vanavar.

In the second stage construction of capacities for thorough processing of wood at Yarki should begin. At the same time the shipment of timber in the log should be organized from industrial points located downstream of the site of the Boguchanskaya GES.

We associate the third stage in development of the economy in this region with organization of the production of petroleum and gas in the upper reaches of the Podkammenaya Tunguska and with the building of capacities for refining them in the areas of Kodinsk or Kezhma.

An analysis of the preconditions and conditions for developing the natural resources of the eastern part of the Angara Valley in Krasnoyarskiy Kray and the adjoining northern portion of Tungusko-Chunskiy Rayon shows that if the process of formation is to be more effective, preparatory work on project plans and scientific research will have to be speeded up, and the infrastructural preparation will have to be conducted in a more organized and purposive manner with all the issues being resolved in an interrelated way.

FORMATION OF THE SOUTH YAKUTIA TPK

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 98-104

[Paper by L. I. Sevast'yanov and V. N. Churashev]

[Text] The place of the South Yakutia TPK in the interregional division of labor is determined by the flow of its principal resources--coking coals and iron ore--into the circulation of the national economy. The problem of building a metallurgical complex in the region east of Lake Baykal has been under study for many years now. Many specialists now recognize the economic feasibility of building a major full-cycle metallurgical plant in the Far East, but the question of siting it is very complicated and remains unresolved to this day. Sites in Amurskaya Oblast and in the south of Yakutskaya ASSR are considered the most promising. The coals of the Southern Yakutia basin are regarded as its only possible source of fuel for all the metallurgical plant's different sites. Moreover, the Tayezhnyy iron ore deposit must be developed if the metallurgical plant is to be fully developed.

Regardless of the specific site for construction of the metallurgical plant in the Far East, it is very important to the national economy to develop the Southern Yakutia coal basin, whose coals could be exported to the countries of the Pacific Ocean and could also be used at existing domestic metallurgical plants. In the 10th Five-Year Plan construction was started on the Neryungri open-pit coal mine, a coal beneficiation mill and the Neryungrinskaya GRES. Commencement of permanent service on the main rail line between Tynda and Berkatit will provide stable transportation connections between Southern Yakutia and the country's other regions.

Comprehensive development of Southern Yakutia's natural resources presupposes the transportation and auxiliary and service operations and facilities of the social-residential infrastructure will lead the way in development. One of the most important problems of forming the South Yakutia TPK is to provide the population with food, well-equipped housing and all forms of cultural and consumer services. In view of the need to conduct a strict labor-saving policy in this region, a check should be made on the advisability of locating certain facilities (the metallurgical plant, enterprises for the production of construction fabrications and components, etc.) in Southern Yakutia (first variant) or outside it, in regions with more favorable conditions for the construction and functioning of the facilities and for the life of the people (second variant).

The South Yakutia TPK is a complex in which the mining industry predominates and where such factors as the limited extent of minerals at certain deposits, the sequence of their development, dates for construction of projects and operating life of enterprises in the mining industry and the construction and building materials industry have a substantial impact on the development and location of production facilities and the engineering-and-technical and social-and-residential infrastructure. Fixed capital for production and nonproductive purposes built in this period of formation of the TPK and its volume and location determine to a considerable extent the subsequent development and location of production projects and facilities of the service sphere. That is why in modeling formation of the TPK we must give consideration not only to spatial connections in the specific periods, but also to the time connection between the subjects of planning. All of this led to the dynamic approach to solving the problems of forming the South Yakutia TPK.

In posing the problem of optimalizing formation of the South Yakutia TPK it was assumed that the scale and pace of development of the natural resources of Southern Yakutia and the thoroughness of their processing, as well as activation dates for projects in other sectors and industries representing specialization were determined in advance from the standpoint of the national economy or the specific sector or industry so as to take into account that sector's or industry's specific nature.* Thus possible strategies for development and location of the metallurgical plant, the coal industry, a number of branches of the mining and timber industry, the fuel and power industry, transportation, depots for repair of machines and equipment and facilities for agricultural production were determined so as to take into account sectoral and regional peculiarities. The same capacity was taken in all the versions compared for the metallurgical plant: full capacity--10 million tons of pig iron, including 5 million tons for the first phase, whose activation is scheduled within the planning period under consideration.** Common to both variants was consideration of the possibility of developing the Chul'man and Denisovskoye deposits of coking coals and the Tayezhnyy iron ore deposit, as were also the construction of such major projects as the Neryungri mine, the beneficiation mill, the Neryungrinskaya GRES, and the Seligrad Mining and Ore Dressing Combine.

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* The problem of optimalizing the production and spatial structure of the South Yakutia TPK was posed jointly with the economics division of the Yakutsk Affiliate of the Siberian Department of the USSR Academy of Sciences, whose staff members also prepared the initial data. P. Ye. Alekseyev and V. P. Grigor'yev, staff members of the Yakutsk Affiliate of the Siberian Department of the USSR Academy of Sciences, participated directly in solving the problem on the computer and in analyzing the results of the solution.

** D'yakonov, F. V., "Socioeconomic Problems of Forming the South Yakutia TPK as a Priority Project in Economic Development of the BAM Zone," in the book: "Metodologicheskiye problemy sotsial'no-ekonomicheskogo razvitiya regionov SSSR" [Methodological Problems in the Socioeconomic Development of Regions of the USSR], Moscow, Nauka, 1979, pp 53-64.

Optimalization of the formation of the production and spatial structures of the South Yakutia TPK consisted of determining variants of the location and development of production facilities and facilities of the service sphere by stages in the complex's formation that ensure fulfillment of assignments for development of the natural resources of the area and formation of other production operations the prospects for whose development were determined in advance as a result of solving problems at a higher level, with minimum costs of construction and operation of all the facilities of the economy of the TPK, while at the same time observing conditions for furnishing the population housing and cultural and consumer services and for the employment of labor and other resources.

In the process of optimalization we determine the rate and sectoral and spatial distribution of capital investments and construction and installation work, the spatial structure of the complex's economy, the possibility of locating enterprises of the construction fabrications and components industry outside Southern Yakutia, the size of the population and the labor supply at the various sites and the rate and sectoral composition of employment in social production, correspondence of the sex-specific composition of the labor supply to the needs of male and female labor of production facilities and the service sphere, location, scale of development and sphere of activity of enterprises in the construction fabrications and components industry (interconnections of sites for construction and consumption of construction fabrications and components), location and scale of development of the social-residential infrastructure, and connections of nearby (Neryungri and Chul'man) sites to intervillage cultural and consumer service facilities. In addition, the results were supposed to afford the possibility of checking adherence to intersector proportions in development of the TPK's economies in the plans of sectors and industries so that measures could be taken in good time to correct possible disproportions.

One of the variants of the linear dynamic model of formation of the production and spatial structures of the TPK was applied to solving this problem.*

The results of solving the problem showed that if the metallurgical plant is sited in Southern Yakutia (the first or "Yakutia" variant), the sum total of construction and operating costs for this interrelated group of projects would be 7 percent more than for the second ("Amur") variant, which calls for this plant to be located at one of the sites in Amurskaya Oblast. Below we give the results of a comparison of the principal indicators of these variants (the first variant in percentages of the second):

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* Sevast'yanov, L. I., and Churashev, V. N., "Posing the Problem of Optimalizing Formation of the South Yakutia TPK and the Model Used," in the book: "Metody analiza i modeli struktury territorial'no-proizvodstvennykh kompleksov" [Methods of Analysis and Models of the Structure of Regional Industrial Complexes], Novosibirsk, Nauka, 1979, pp 173-184.

	Total	In Southern Yakutia Alone
Discounted construction and operating costs	107.0	
Capital investments over the planning period	112.8	162.0
Volume of construction and installation work in the planning period	114.0	158.5
Size of the population in the last year of the planning period	94.4	123.9

The virtue of the "Amur" variant for location of the metallurgical plant is that if it were carried out the size of the population living in Southern Yakutia, i.e., in a region with less favorable conditions for human life, would be approximately 24 percent smaller in the last year of the period under consideration than for the "Yakutia" variant. But on the other hand the "Yakutia" variant, which guarantees more efficient utilization of the capacities of the construction and building materials industry, requires a 5-percent smaller labor supply than the "Amur" variant to build and operate the entire complex of projects under consideration, including projects located outside Southern Yakutia.* Thus the final decision on the specific site for construction of the metallurgical plant in the Far East can be taken only after a specific socioeconomic study is made.

The variants obtained for formation of the complex differ essentially in their sectoral and spatial structures, in the rate of capital investment and the pace of construction and installation work to be done within Southern Yakutia (Table 1).

Table 1. Distribution of Capital Investments and Construction and Installation Work Over the Periods of Formation of the South Yakutia TPK, in percentage†

Period	1st Variant	2d Variant
I	15.6/ 16.7	26.6/ 26.4
II	15.6/ 17.9	24.0/ 26.4
III	21.1/ 21.4	19.0/ 18.9
IV	25.0/ 23.8	16.4/ 15.1
V	22.7/ 20.2	14.0/ 13.2
Total	100.0/100.0	100.0/100.0

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† In Tables 1 and 2 capital investments are given in the numerator and construction and installation work in the denominator.

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* But different results might be obtained if a more detailed examination is made of the "Amur" variant.

Table 2. Spatial Distribution of Capital Investments and Construction and Installation Work for the Variants of Formation of the South Yakutia TPK, in percentage*

Site	First Variant	Second Variant
Neryungri	32.0/ 32.1	59.5/ 60.4
Chul'man	37.5/ 35.7	
Tayezhnyy	8.6/ 9.5	3.8/ 3.8
Aldan	16.4/ 16.7	26.6/ 26.4
Tommot	5.5/ 6.0	10.1/ 9.4
Total	100.0/100.0	100.0/100.0

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* In Tables 1 and 2 capital investments are given in the numerator and construction and installation work in the denominator.

The different sites of the metallurgical plant affect not only the spatial distribution of capital investments and construction and installation work in Southern Yakutia (Table 2), which is quite normal, but also the spatial organization of that region's economy. Under the first variant the South Yakutia TPK is formed as a combination of five industrial parks: Neryungri, Chul'man, Tayezhnyy, Aldan and Tommot. According to the second variant the Chul'man site would gravitate toward the Neryungri site in its production connections and cultural and consumer-service connections, which would bring about unification of the economy of these two sites into a single Neryungri or Neryungri--Chul'man industrial park.

Regardless of where the Far Eastern metallurgical plant is built, the needs of the construction sites of the South Yakutia TPK for construction fabrications and components are met more efficiently by organizing the relevant local enterprises in the parks where construction is concentrated, since building the complex of the construction fabrications and components industry outside Southern Yakutia (in Amurskaya Oblast, for example), because of sizable costs of shipping the fabrications and parts to the construction sites in Southern Yakutia, would substantially increase the total costs for construction and operation of the complex. The cost increase ranges from 12 percent for the Neryungri--Chul'man industrial park to 100 percent for the Aldan and Tommot industrial parks.

Settlement of the question of the site for construction of the metallurgical plant affects not only the sectoral, but also the spatial distribution of the labor supply, to which the geographic distribution of the population will conform (Table 3).

Whereas under the first variant the Neryungri and Chul'man sites concentrate more than half of the population of Southern Yakutia on a permanent basis, under the second variant their relative share decreases by the last period. The Tayezhnyy site undergoes considerable development in both variants. With slight changes in the relative share from one variant to another, the population of the Aldan industrial park more than triples.

Table 3. Distribution of the Population of the South Yakutia TPK According to the Variants of Its Formation, in percentage

Industrial Park	First Variant: End of 1st Period	First Variant: End of Last Period	Second Variant: End of 1st Period	Second Variant: End of Last Period
Neryungri (Neryungri--Chul'man)	32.8	24.0	57.4	40.7
Chul'man	26.1	24.0	--	--
Tayezhnyy	0.8	11.5	1.8	5.1
Aldan	26.8	26.5	25.2	34.0
Tommot	13.5	14.0	15.6	20.2
Total for the TPK	100.0	100.0	100.0	100.0

In every industrial park of the South Yakutia TPK economic sectors with a slightly larger need for male labor resources would develop in both variants of its formation. But a sufficiently high level of intended rates of development of the social-residential infrastructure, in whose labor force women are predominant, would result in adherence to the intended proportions in the use of male and female labor at each site.

The location and pace of construction of the complex's projects have a decisive impact on the geographic distribution of the population and the rate of population growth. For instance, whereas under the first variant the successive construction of the projects of the Neryungri Coal Complex and the metallurgical plant would guarantee relative stability of the labor force employed in construction and the construction fabrications and components industry, under the second variant completion of the bulk of the work at Neryungri would bring about a sharp reduction in the number of construction workers in the Neryungri--Chul'man industrial park, which would be offset by the increased number of workers in other sectors and industries.

In each industrial park construction and installation facilities would have their own capabilities to carry out the construction program; their total labor force would consistently drop as the volume of construction increased because of the faster growth of labor productivity. But the dynamic pattern of the number of construction workers at the various sites would be quite uneven and would depend on distribution of the need for construction and installation work from one period to another and on relations between the sites in meeting those requirements. For example, under the first variant the major capability of construction and installation work built in the first period at Neryungri would cut back sharply on the volume of its work at Neryungri in the second period, and the unused capacities would in part be held in reserve, and part would be transferred to the other sites

(Tayezhnyy, Aldan and Tommot). The capacities held in reserve would be activated only in the fifth period and would ensure fulfillment of the entire volume of construction and installation work in Neryungri. During the three intervening periods the bulk of construction and installation work at Neryungri would be done through the efforts of construction and installation organizations based in Chul'man. Moreover, mathematical-economic analysis of the plan obtained for formation of the South Yakutia TPK under the first variant shows that if provision is not made for the possibility of partial relocation of the capacities of the Neryungri base of construction and installation organizations, but they are rebuilt to their full extent at Tayezhnyy, Aldan and Tommot, the cost increase would be 16 percent.

Under the second variant, of course, a single base of operations of construction and installation organizations would be formed at the Neryungri--Chul'man industrial park. In this case partial transfer of its capacities would still occur in the same directions, but the scale would be considerably reduced.

The possibility of transferring construction and installation organizations simplified solution of the problem of guaranteeing proportions between development of local construction facilities and the need for their capacities. Relocation of the facilities of construction and installation organizations proved to be more efficient than joint use of such methods as building and liquidating capacities and lengthening construction time of individual projects by commencing work on them at an earlier date. This also affected the results: none of the methods that called for longer construction times was included in optimum plans for the two variants of formation of the South Yakutia TPK. But this does not mean that longer project construction time is inefficient in all cases.

A significant feature of development of the construction fabrications and components industry in Southern Yakutia in both the variants were the intersite (interpark) relations in the production and consumption of the products of this industry as the capacities of its industries undergo successive growth. All industrial parks without exception share to some degree or other in the intersite connections with respect to the supply of construction fabrications and components either as suppliers or consumers. For example, deliveries of construction fabrications and components from Tayezhnyy to other sites exceeeds in certain periods 70 percent of the total volume of their production at that facility.

Successful fulfillment of the program for formation of the TPK depends greatly on building in good time and on the necessary scale the complex of housing facilities and facilities in the sphere of cultural and consumer services for the population. Development of the service sphere in Southern Yakutia will be affected by three factors: the growth of the labor force in the production sphere, the increase in the relative share of dependents in the total population and the rise in the level of cultural and consumer services to the population. But here the impact of the second factor will be negligible, but the first and third will be operative throughout the entire planning period. Moreover, in spite of the high growth rates of the labor force, in the sphere of production the need to raise the level of housing supply and cultural and consumer services to the population will have the most essential impact on the scale and pace of development of the social-residential infrastructure.

Under the first variant for formation of the South Yakutia TPK, which calls for creation of independent industrial parks in Neryungri and Chul'man, Chul'man would become the center for intervillage service of the population of these nearby sites. But mathematical-economic analysis of the results of solution of the problem showed that it was permissible to build at Neryungri its own complex of facilities of intervillage significance, since in this case the sum total of construction and operating costs would increase negligibly.

The results of solving the problem for optimalization of formation of the South Yakutia TPK show that there could be a shortage of its own capacities for generating electric power (only in the first period), for production of agricultural products and for repair of machines and equipment.

The shortage of electric power in the first period could be covered from the capacities of the Zeyskaya GES, which would mean putting transmission lines between Tynda and Neryungri into service in good time. In subsequent periods the need for electric power of all the projects of the South Yakutia TPK would be covered by putting successive phases of the capacities of the Neryungrinskaya GRES on line. The shortage of farm products would presumably be covered by importation from other regions of the country. The intended construction of two relatively large repair enterprises at Neryungri and Chul'man would not meet the needs of all production operations of the complex for machine and equipment repairs. Additional studies are therefore needed to settle the question of making up this shortage.

Use of a linear dynamic model to optimalize the spatial structure of the South Yakutia TPK thus made it possible to furnish a preliminary assessment of the variants for location of the Far Eastern metallurgical plant, to examine the process of formation of the economy of Southern Yakutia and to discover additional potential for improved use of physical resources and labor resources assigned to its development.

ASPECTS OF DEVELOPMENT OF THE PRODUCTIVE FORCES AND PREPLANNING STUDIES

DYNAMIC PATTERN OF EMPLOYMENT, LABOR PRODUCTIVITY AND FIXED PRODUCTIVE CAPITAL IN SIBERIA'S INDUSTRIAL SECTOR

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 105-112

[Paper[1] by T. B. Baranova, Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences, Novosibirsk]

[Text] The growth of the number of industrial production personnel in Siberia in the 1961-1975 period almost coincided with the growth for the USSR as a whole (1.49- and 1.47-fold, respectively), but there was a rather appreciable difference between them if the growth rates are taken by 5-year periods. Only in the Eighth Five-Year Plan did the growth rate of industrial personnel in Siberia exceed the national growth, the difference being 3.8 percentage points. In the seventh and eighth five-year plans, on the other hand, the difference to the advantage of the USSR was 3.0 and 5.9, respectively. Consequently, a particularly noticeable slowing down of the growth of industrial production personnel in Siberia as compared to the USSR as a whole occurred in the Ninth Five-Year Plan.

In the industrial sector of the USSR the number of production personnel showed the highest growth rates in the chemical and petrochemical industries, machinebuilding, electric power industry, the food industry and the building materials industry. In Siberia the growth rate of the number of industrial production personnel was higher than the national rate in the chemical and petrochemical industries and in machinebuilding; it was somewhat lower in light industry and ferrous and nonferrous metallurgy, though the growth rates of the number of industrial production personnel were higher in Siberia than for the USSR as a whole in the last three industries. In Siberia's fuel industry the number of production personnel increased 7 percent between 1960 and 1975, whereas in the country's fuel industry the number of industrial personnel dropped 8.6 percent in that period. Consequently, the chief difference in the dynamic pattern of employment in the industrial sector of Siberia as compared to that of the USSR is the faster growth of the number of persons employed in raw materials industries, which reflects Siberia's enhanced role in national production of the products of these industries. The dynamic pattern of the number of persons employed in the industries of the two economic regions differs noticeably in the period under review.[2] Whereas for the industrial sector as a whole the number of industrial production personnel increased practically the same (1.49-fold) in the West Siberian and East Siberian regions, there is a noticeable differentiation of the principal industries with respect to the growth rates of employment. The largest increase of the labor force in the 1961-1975 period, in a breakdown by consolidated industries, was in the chemical and petrochemical industries (2.4-fold in West Siberia and 1.9-fold in East Siberia) and machinebuilding (1.8- and 1.9-fold, respectively). The drop in the number of industrial production personnel in nonferrous metallurgy and the timber industry of West Siberia was accompanied by a noticeable increase in these same industries in East Siberia (1.5- and 1.3-fold, respectively). We should note the higher growth rates of the number of industrial production personnel in the electric power industry and fuel industry of West Siberia as compared to East Siberia.

On the whole the changes in the distribution of labor force among Siberia's industries coincide with analogous changes in gross output.

The growth rates of employment in the industries of Siberia, just as in the USSR as a whole, were considerably lower than the rates of increase of the volume of production in the respective industries. A sizable share of the growth was achieved by raising labor productivity. In Siberia's industrial sector labor productivity increased to a larger extent over the period under review than in the industrial sector of the USSR as a whole; moreover, the highest growth rates over this period were maintained in East Siberia. Below we give the growth rates of labor productivity (based on gross output) in percentages relative to 1960.[3]

	1965	1970	1975
USSR	126	166	221
Siberia	128	171	236
West Siberia	122	160	223
East Siberia	139	193	261

The level of labor productivity in the industrial sector of Siberia (based on gross output) was 95 percent of the all-union level in 1960; in 1975 it already exceeded the latter by 2 percent.

As in the USSR as a whole, so in Siberia the growth rates of the capital-worker ratio exceeded the growth rates of labor productivity in all industries (except for the chemical and petrochemical industry in Siberia) (Table 1).

A comparison of the levels of the capital-worker ratio in the industries of the USSR and Siberia in 1960 and 1975 reveals substantial changes in their relationship. Whereas in 1960 the capital-worker ratio in Siberian industry as a whole was at the average union level, in 1975 it already exceeded the average union level by 34 percent. In only three industries in 1960 (chemical and petrochemical, machinebuilding and building materials) was the level of the capital-worker ratio higher than the average union level (it was particularly high in the chemical industry, double the average union level). In all the other industries the level of the capital-worker ratio was considerably lower than the industry average for the USSR as a whole. The largest lag behind the average union level on the basis of this indicator was recorded by the fuel industry (57 percent), the food industry (70 percent) and light industry (79 percent). In 1975 the level of the capital-worker ratio in all industries of Siberia exceeded the average level of the respective industry for the country as a whole. One exception was the food industry, in which the level of the capital-worker ratio increased only slightly toward the average union level over the period in question (in 1975 it reached 76 percent).

Table 1. Growth Rates of Labor Productivity and the Capital-Worker Ratio (1975/1960, in percentage)

Industry	Labor Productivity		Capital-Worker Ratio	
	USSR	Siberia	USSR	Siberia
Industrial sector as a whole	221	236	273	365
Electric power industry	223	342	305	437
Fuel industry	278	338	346	644
Ferrous metallurgy	201	177	276	425
Chemical and petrochemical industry	296	298	336	167
Machinebuilding	302	258	233	243
Timber and lumber industry	208	203	299	424
Building materials industry	246	220	319	275
Light industry	168	194	262	389
Food industry	185	167	258	282

The level of the capital-worker ratio achieved in the fuel industry, the timber and lumber industry and ferrous metallurgy was the highest by comparison with the average national level of the respective industry. The capital-worker ratio based only on the value of the active portion of fixed productive capital--machines and equipment--rose to a greater extent in Siberia's industrial sector over the period under review than the same indicator for the industrial sector of the USSR as a whole. Whereas in 1960 the level of the capital-worker ratio (based on the value of machines and equipment) in Siberia's industrial sector exceeded the union level only 1.8 percent, in 1975 it already exceeded it by 60 percent.[6]

The dependence of the growth of labor productivity on the rise of the capital-worker ratio was as follows in the industrial sector of Siberia between 1961 and 1975: $Y/L = 1.003\ (K/L)^{0.7105}$. Consequently, under those conditions a change of 1 percent in the capital-worker ratio yields a 0.71

percent increase in labor productivity: 0.72 in West Siberia and 0.70 in East Siberia.

Over the 15-year period under consideration the value of fixed productive capital in the industrial sector of Siberia increased 4.89-fold, whereas in the industrial sector of the entire country it increased 3.86-fold. At the same time the rate of growth of the value of fixed industrial productive capital was higher in East Siberia (5.46-fold).[5]

In the industrial sector of the USSR as a whole, in the industrial sector of Siberia as a whole and in that of its eastern portion we see a tendency toward lower average annual growth rates of the value of fixed productive capital from one 5-year period to the next (see below). In the industrial sector of West Siberia the pattern of average annual growth rates of the value of fixed productive capital is somewhat different: the highest average annual growth rate occurred in the Ninth Five-Year Plan:

	1961-1965	1966-1970	1971-1975	1961-1975
USSR	10.9	8.7	8.6	9.4
Siberia	11.8	10.8	10.8	11.2
West Siberia	10.8	9.8	11.0	10.5
East Siberia	13.3	12.0	10.6	12.0

The fact that the industrial sector of Siberia has had higher growth rates of the value of fixed productive capital than the union as a whole has increased Siberia's relative share of the volume of fixed productive capital of the USSR's entire industrial sector. The tendency toward a gradual increase in Siberia's share in the value of all-union fixed industrial productive capital can be traced over this entire period. The relative share of Siberia (in percentage) in union increments of the value of fixed industrial productive capital has been increasing noticeably:

	1961-1965	1966-1970	1971-1975	1961-1975
USSR	100.0	100.0	100.0	100.0
Siberia	9.6	11.9	13.1	11.9
West Siberia	5.1	6.1	7.3	6.4
East Siberia	4.5	5.8	5.8	5.5

The average annual growth rates of the value of fixed productive capital (over the 5-year period) have as a rule been higher in the industries of Siberia than in the respective industries of the USSR as a whole. Exceptions are machinebuilding in the food industry in the Seventh Five-Year Plan and the building materials industry in the eighth and ninth five-year plans. As for the chemical and petrochemical industries, these are the only industries where the average annual growth rate of the value of fixed productive capital has been lower than the all-union rates over the entire period.

The predominant share of the extractive industries is a peculiarity of the industrial structure of the fixed productive capital of Siberian industry. For instance, the share of the fuel industry in the value of fixed productive capital of the industrial sector increased substantially by 1975, whereas for the USSR as a whole we have seen a decline in the share of this industry. On the other hand, whereas the country's industrial sector is typified by a stable growth of the relative share of machinebuilding in the value of total fixed industrial capital, in Siberia this has not been noted. By contrast with the industrial sector of the USSR, in Siberia there was an increase in the share of light industry in the value of this capital, which resulted from an increase in the production capacities of this industry primarily in East Siberia. A manifestly adverse tendency in the structural changes taking place in the industrial sector of Siberia over the period under review is the gradual drop in the share of the chemical and petrochemical industries and building materials industry in the value of fixed productive capital.

A noticeable portion of the all-union growth of the value of fixed productive capital is accounted for by Siberia in such industries as the timber and lumber industry, the fuel industry, and the electric power industry; a very small share is accounted for by its food industry.

The fact that the value of fixed productive capital increased faster than the volume of production caused a drop in the output-capital ratio in Siberian industry. By the beginning of this period the output-capital ratio in Siberian industry was almost equal to the average union level, and in 1975 the gap was already 24 percent. Every year the output-capital ratio has been dropping an average of 2.3 percent: 2.6 percent in the industrial sector of East Siberia and 2 percent in West Siberia.

Among the factors bringing about this drop in the output-capital ratio we should mention first of all structural shifts (a rise in the relative share of capital-intensive industries) and the low efficiency of technical progress and capital construction. A lengthening of construction times, an increase in the volume of unfinished construction, and a rise in the estimated cost of projects--all of this has tended to make fixed capital more expensive without a corresponding increase in its return. Over the last three 5-year periods the share of partial construction in the total size of productive capital investments of Siberia increased from 11.3 in the Seventh Five-Year Plan to 12.3 percent in the ninth. In the Ninth Five-Year Plan construction work representing partial completion constituted 5.2 billion rubles of capital investments.[6]

The share of capital investments in Siberia's industry and in the industry of the entire country has been growing with each successive 5-year plan: in the Ninth Five-Year Plan it rose 6.6 percentage points over the seventh. The reason for this is primarily the substantial rise of capital investments in Siberia's fuel industry (the share of the fuel industry in total capital investments in Siberia's industrial sector was more than twice as great in the Ninth Five-Year Plan as in the seventh). Siberia's share in the total volume of capital investments in the fuel industry of the entire country was threefold larger in the Ninth Five-Year Plan than in the seventh and obtained one-fourth of the capital investments in that entire industry.

The dynamic pattern of the sectoral distribution of capital investments in Siberia's industry differs notably from the all-union pattern. Whereas machinebuilding has the largest share in capital investments in the industrial sector of the USSR as a whole, in Siberia this industry has a very small share. In the industrial sector of the USSR the share of the electric power industry has been increasing from one five-year plan to the next. The opposite tendency is typical of Siberia. As a result Siberia's share in capital investments in the USSR's electric power industry in the Ninth Five-Year Plan proved to be 8.3 percentage points less than in the seventh. The share of investments in ferrous metallurgy is lower in Siberia than in the country as a whole; the pattern of its change in Siberia has also differed from the all-union tendency: in USSR industry the share of ferrous metallurgy dropped in the Eighth Five-Year Plan, but rose in the ninth; in Siberia, however, it has been dropping from one 5-year period to the next. A similar pattern of change pertaining to the industry's share in total capital investments in the industrial sector has been inherent to the chemical and petrochemical industries, the building materials industry and food industry of Siberia, for which we cannot find justification.

Tardy renewal of the active part of fixed productive capital at existing enterprises should be seen as one of the reasons bringing about the drop in the output-capital ratio in the industrial sector.[7]

In the seventh through the ninth five-year plans the average annual growth rates of the active part of fixed productive capital in the industrial sector of the USSR exceeded those of fixed productive capital as a whole. In Siberian industry there was a different relationship in the growth rates of total fixed productive capital and its active part. Below we give the coefficients of the difference by which the annual growth rates of fixed industrial productive capital exceeded the growth rates of its active part.

Year	USSR	Siberia
1961	0.960	0.993
1962	1.000	1.002
1963	1.137	0.977
1964	0.920	1.020
1965	1.006	1.014
1966	1.013	0.984
1967	1.011	0.994
1968	1.004	1.003
1969	1.014	1.008
1970	1.015	0.987
1971	1.027	1.023
1972	1.028	1.002
1973	1.048	0.993
1974	1.004	0.983
1975	1.019	0.992

The share of the growth of the value of the active part in the growth of the value of the total productive capital of Siberian industry was 35.1 percent in 1961 and only 31.9 percent in 1975. The growth rates of the passive part of capital slightly exceeded the growth rates of its active part. As a result the distribution of fixed productive capital in Siberian industry as a whole and in the industry of each of its two economic regions has been deteriorating (Table 2). And whereas in 1960 the relative share of the active part in the value of fixed productive capital of West Siberia coincided with the nationwide level, in 1975 the gap was 2.3 percentage points, and in the industry of East Siberia the gap increased over that same period from 2.3 points in 1960 to 6 points in 1975.

Table 2. Relative Share of Machines and Equipment in the Value of Fixed Productive Capital of the Industrial Sector

Year	USSR	Siberia	West Siberia	East Siberia
1960	33.3	32.9	34.0	31.3
1961	33.7	32.7	33.7	31.4
1962	34.0	32.8	33.0	32.4
1963	33.0	32.0	33.5	29.9
1964	34.0	32.6	34.2	30.5
1965	34.0	33.0	34.6	31.0
1966	34.0	32.6	34.4	30.2
1967	34.0	32.4	34.2	30.3
1968	34.0	32.4	34.3	30.2
1969	34.6	32.7	34.8	30.2
1970	34.8	32.3	34.0	30.3
1971	35.3	33.1	34.9	30.9
1972	35.3	33.1	34.9	31.0
1973	35.9	32.9	34.7	30.7
1974	36.1	32.3	34.3	29.9
1975	36.0	32.0	33.7	30.0

It is very important to improvement of the distribution of fixed industrial productive capital to write off old machines and equipment in good time, to carry out timely reconstruction projects and replace obsolete machines and equipment, and to make the optimum distribution of funds between major repairs and replacement.

An analysis of the distribution of depreciation deductions in the industrial sector of the USSR and Siberia shows a higher share of major repairs in the depreciation deductions in Siberian industry and a weak tendency toward an increase in the share of deductions for replacement by contrast with the industrial sector of the USSR as a whole (Table 3). Attention is drawn to the particularly unfavorable situation in the industrial sector of East Siberia, where the share of major repairs and depreciation deductions even increase somewhat by the end of the period under consideration. The tendency outlined in the Eighth Five-Year Plan to increase the overall rate of depreciation in Siberian industry did not persist in the Ninth Five-Year Plan, and in this period we observe a drop in the rate of depreciation both in the industry of Siberia as a whole and in its regions (Table 4). These tendencies are the reason why efficiency in utilization of capital is dropping off.

Table 3. Relative Share of Deductions for Full Replacement and Major Repair of Fixed Productive Capital in Depreciation Deductions in the Industrial Sector, in percentage

	1965		1975	
	For Full Replacement	For Major Repairs	For Full Replacement	For Major Repairs
USSR	54.1	45.9	61.0	39.0
Siberia	53.4	46.6	52.0	48.0
West Siberia	53.9	46.1	54.9	45.1
East Siberia	52.9	47.1	52.7	47.3

Table 4. Depreciation Deductions in the Industrial Sector (Relative to the Value of Average Annual Fixed Industrial Capital, in percentage)

	USSR	Siberia	West Siberia	East Siberia
1965				
Total	7.4	7.3	7.6	6.8
Breakdown:				
For full replacement	4.0	3.9	4.1	3.6
For major repairs	3.4	3.4	3.5	3.2
1970				
Total	7.4	7.7	7.7	7.7
Breakdown:				
For full replacement	4.0	4.1	4.1	4.1
For major repairs	3.4	3.6	3.6	3.6
1975				
Total	7.7	7.5	7.1	7.4
Breakdown:				
For full replacement	4.7	3.9	3.9	3.9
For major repairs	3.0	3.5	3.2	3.5

Accelerated development of the fuel industry and above all petroleum production has had a noticeable impact on indicators of labor productivity and the output-capital ratio in Siberian industry and the industry of West Siberia in particular. For instance, omission of the fuel industry lowers the growth rate of labor productivity between 1960 and 1975 by 10 points and the capital-worker ratio by 18 points and reduces the rate of reduction of the output-capital ratio by 1 point. Omission of petroleum production brings about a still larger change in these indicators: labor productivity drops 11 points, the capital-worker ratio 26 points, and the drop in the output-capital ratio is still smaller. Moreover, omission of the fuel and petroleum industries from the figures for 1965 did not make a difference, and omission of the fuel industry even somewhat improved those indicators. The same results are obtained by calculations of the indicators for the industry of West Siberia if we omit Tyumenskaya Oblast.

Thus the principal difference in the dynamic pattern of the size of the labor force and the value of fixed capital in Siberian industry is that they are growing faster in the extractive industries.

FOOTNOTES

1. Procedures for discovering development trends and the advantages and shortcomings of the various methods have been set forth in detail in the following places: Anchishkin, A. I., "Prognozirovaniye rosta sotsialisticheskoy ekonomiki" [Forecasting the Growth of a Socialist Economy], Moscow, Ekonomika, 1973; Chetyrkin, Ye. M., "Statisticheskiye metody prognozirovaniya" [Statistical Methods of Forecasting], Moscow, Statistika, 1977. The calculations were made according to a program of T. P. Ul'yanova entitled "Selection of Tendencies and Forecasts," worked out in IEiOPP SO AN SSSR. See "Statisticheskiye algoritmy i programmy" [Statistical Algorithms and Programs], edited by M. F. Borodkin and M. L. Lukatskaya, Novosibirsk, 1970.

   The program makes it possible to select the best of 15 functions. The principal quantitative criterion governing selection of the right type of function of the trend was the minimum of residual dispersion and the ratio of residual to original dispersion. Below we will give the principal statistical characteristics of the regression equations derived in this project--the mean square errors (S_a, S_b), the magnitude by which the values of the regression coefficients exceed their mean square errors (T_a, T_b), the mean value of the indicator being studied ($\overline{y}$), the deviation from the mean value ($S_{\overline{y}}$), the value of the standard error of estimate (S_{ost}) of the equation of trends and the correlation coefficient (R):

S_a	T_a	S_b	T_b	S_{ost}	$\overline{y}$	$S_{\overline{y}}$	R	
0.0002	-4.36	0.0039	12.64	0.0168	1.279	0.1517	0.995	(1)
0.0002	-5.54	0.0037	14.16	0.0162	1.285	0.1596	0.996	(2)
0.0002	-2.51	0.0038	10.61	0.0185	1.268	0.1531	0.994	(3)
0.0003	13.76	0.0050	4.22	0.0220	1.558	0.4271	0.999	(4)
0.0006	12.19	0.0104	2.36	0.0451	1.894	0.7210	0.998	(5)
0.0006	20.16	0.0110	4.07	0.0461	2.232	0.9184	0.999	(6)
0.0008	14.08	0.0149	1.23	0.0645	2.349	1.0880	0.998	(7)
0.0005	24.16	0.0103	4.91	0.0452	2.191	0.9041	0.999	(8)

   All these equations of the trends are significant with a probability of error of less than 5 percent and are, then, usable for economic analysis.

2. The variation of the index numbers of the growth of the number of production personnel in Siberian industry is approximated by this second-degree polynomial:

   $$L = 0.952 + 0.049t - 0.001t^2.$$

   Whereas at the outset of the period the annual growth of the labor force was 4.7 percent from the 1960 level, at the end of the period it was only 1.3 percent. The average annual absolute growth of the labor force dropped 0.2 percent from the initial level. The change in the index numbers of the growth of the number of production personnel in the industrial sector of the two regions of Siberia is described by these polynomials:

   $L = 0.943 + 0.053t - 0.001t^2$ for West Siberia and

   $L = 1.122 + 0.072t - 0.0005t^2$ for East Siberia.

   On the basis of these polynomials it becomes clear that the annual drop in the absolute growth of the number of production personnel in the industry of West Siberia was 0.02 percent of the initial level between 1961 and 1975, and in the industry of East Siberia it was 0.1 percent.

3. The calculations were made according to the data of the statistical yearbooks "Narodnoye khozyaystvo SSSR" [USSR National Economy] for the respective years.

4. The dynamic pattern of productivity and the capital-worker ratio in Siberia's industrial production in the 1961-1975 period is approximated quite well by the following functions:

   $$Y/L = 1.0096 + 0.0212t + 0.0039t^2 \text{ and} \tag{4}$$

   $$K/L = 1.0046 + 0.0245t + 0.0073t^2 \tag{5}$$

   in which Y--gross output of the industrial sector, K--value of fixed industrial productive capital, L--number of industrial production personnel.

   Comparison of these two functions makes it possible to discover that the capital-worker ratio is growing faster than labor productivity. For instance, whereas on the average over the period the annual increase in the growth of gross output per worker was 0.8 percent from the 1960 level, the annual increase in the growth of the value of fixed productive capital per worker was 1.4 percent.

5. The rate of increase of the value of fixed productive capital for the industrial sector of Siberia is approximated quite well by a second-order parabolic equation

$$K = 1.000 + 0.044t + 0.012t^2 \qquad (6)$$

which characterizes the accelerating growth of the volume of capital. The annual rate of growth calculated from the trend was 7.0 at the beginning of the period and 9.6 percent at the end. The magnitude of the absolute growth of the value of capital increased 5.3-fold over the period under consideration. The absolute growth in 1975 was 40.2 percent of the 1960 level. The absolute growth of the value of capital increased over the period at an average annual rate of 2.4 percent against the value of capital in 1960. This growth is distributed as follows between the regions: the share of West Siberia is 58.5 percent and that of East Siberia 41.5 percent.

The dynamic pattern of the growth of the value of fixed productive capital in the regions of Siberia is described by the following equations:

$$K = 1.068 + 0.019t + 0.012t^2 \text{ for West Siberia and} \qquad (7)$$

$$K = 0.904 + 0.08t + 0.013t^2 \text{ for East Siberia.} \qquad (8)$$

The principal difference between the trends reflecting the dynamic pattern of capital in West and East Siberia lies in the different tendencies of variation of the rates of annual growth. In the industrial sector of West Siberia there was a growth of the theoretical annual growth rates (from 5.0 percent in 1961 to 9.6 percent in 1975), whereas in the industrial sector of East Siberia this indicator dropped (from 11.9 percent in 1961 to 9.6 percent in 1975). Though the average value of the annual increase of the absolute growth of the value of capital was 2.4 percent of the value of capital in 1960 in both cases, the absolute growth was higher in the industrial sector of West Siberia.

6. "Razvitiye narodnogo khozyaystva Sibiri" [Economic Development of Siberia], Novosibirsk, Nauka, 1978, p 78.

7. Sitin, V. K., and Yakovets, Yu. V., "Ekonomicheskiy mekhanizm povysheniya effektivnosti proizvodstva" [Economic Mechanism for Raising Production Efficiency], Moscow, Ekonomika, 1978, p 181.

PROBLEMS OF THE ECONOMIC AND SOCIAL DEVELOPMENT OF THE SOUTH OF WEST SIBERIA

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 112-121

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[Text] Most economists engaged in studies of the Siberian economy,* include Kemerovskaya and Novosibirskaya oblasts and Altayskiy Kray in the region referred to as the south of West Siberia. In the size of its gross social product this region exceeds the Volgo-Vyatskiy, Central Chernozem and East Siberian economic regions, it is characterized by a higher level of industrial development, and it has a large concentration of urban population.

In the years of Soviet power an exceedingly large industrial region with a highly advanced agriculture has been built in the south of West Siberia. The sectors and industries which represent the specialization of the south of West Siberia mainly took shape in the prewar period and have performed the task of providing the European regions and the Urals with fuel, power and metal. During World War II the machinebuilding industry made its appearance here (because of the evacuation of a number of enterprises from the west) along with a number of other manufacturing industries, which became concentrated alongside the major sources of raw materials and energy.

In the period of formation of the economic complex in the south of West Siberia this tradition brought a noticeable benefit. It guaranteed a saving on capital and operating costs by comparison with "piecemeal" location of enterprises and brought social amenities to the large cities. But as time passed, especially in the postwar period, its adverse aspects began to show themselves as well--the lag of the industrial development of the small urban settlements which have favorable preconditions for industrialization, and the nonoptimum interregional connections among the manufacturing industries that constitute specialization. Delivering the smaller portion of its output to this zone (including its own territory), the region exported the bulk of its output to the European and Urals zones, which in turn was the predominant source for meeting the needs of the east of the republic. Consequently, between east and west there were constant large-scale cross hauls of products of one and the same industries, not uncommonly products even of the same designation, though with different performance characteristics. This resulted in sizable transportation costs, a heavy load on rolling stock, and a noticeable drop in production efficiency in the eastern zone of the republic.

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* "Ekonomicheskiye problemy razviti Sibiri" [Economic Problems of Siberian Development], Novosibirsk, Nauka, 1974, pp 109-110.

The tasks of comprehensive economic development in the south of West Siberia also necessitate correction of another major shortcoming--the lag of the material and technical base in the construction industry, which has resulted in a scattering of operations over numerous projects and a large volume of unfinished construction carried over from one 5-year period to the next.

Moreover, because of underutilization of the productive capital which has been built, the output-capital ratio has shown a tendency to decline: it dropped 26.3 percent between 1960 and 1975.

Highly developed agriculture is the basic branch of the region's agroindustrial complex. But the rise in the yields of crops and the higher productivity of animal husbandry depend to no small degree on weather conditions. That is why one of the most important tasks facing the region is to build stable cropping, to furnish the proper capacities to the industry processing agricultural products, and to improve the transport, storage and delivery of these products to the consumer.

Correction of these shortcomings is an urgent task of multiannual planning. The sizable economic potential already built in the south of West Siberia must be borne in mind in drafting the region's plan of economic and social development, and a determination must also be made as to which sectors of the economy need to be developed within it. In the 11th Five-Year Plan no important changes were planned in the structure of the region's economy, but measures to raise its efficiency were to be accomplished mainly thanks to the industries representing specialized production as well as by developing the branches of material production and the social infrastructure that round out the complex.

At the present time the industries representing the specialization of the south of West Siberia are the coal industry, metallurgy, machinebuilding and the chemical industry. These industries account for two-thirds of the gross output of the region's industrial sector and about 70 percent of the fixed productive capital and industrial personnel.

There is no doubt of the advisability of a further sizable development of the coal industry of the Kuzbass. It is based on the tremendous size of the coal resources favorable for commercial development (more than 46 percent of union reserves), by the high quality of the coals, by the great diversity of their physical and chemical composition, and by the shallow location of the coal seams (thicker than in the Donbass). The imputed cost of mining 1 ton of Kuzbass coal in a long-range projection is barely half that of Donetsk coal, which justifies the long-distance shipment of Kuzbass coal and guarantees the economic efficiency of its extensive use in the European part of the country.

Because of a certain lag in construction of new enterprises and expansion of existing ones the Kuzbass' most important task in the 11th Five-Year Plan is to lay a large foundation for the growth of production capacities for future use. For instance, construction will presumably begin on the Taldinskiy coal basin in Yerunakovskiy Rayon, the largest in the Kuzbass, where coking coals predominate, where open-cut mining is possible, and where the reserves are equal to those of the Donbass. The projected output of the mine is 30 million tons. Construction of a number of major beneficiating mills--Prokop'yevsk, Taldinskiy, Krasnobrodskiy, the second phase of "Sibir'," and Raspadskiy--is proposed for fuller enrichment of the mined coal.

Thanks to the inexpensiveness of the Kuznetsk coking coals it is economically advantageous to produce ferrous metals in the south of West Siberia. The production cost of finished rolled products is lower at the West Siberian Metallurgical Plant (Zapsib) and the Kuznetsk Metallurgical Combine (KMK) than at most of the country's metallurgical plants. That accounts for the high urgency of the task of further enlargement of the production capacities of Zapsib and technical reconstruction of the KMK (operating since 1932) in the shortest possible time.

In the south of West Siberia more than 90 percent of rolled products of ferrous metals are produced. In the distant future the region's relative share will drop because of the development of ferrous metallurgy in the Far East and in East Siberia, but in that context the south of West Siberia will remain the principal metallurgical center of the republic's eastern zone. It is accordingly an important task of the region's ferrous metallurgy to improve the quality of the metal and to organize production of cold-resistant steel for the "northern version" of equipment and for construction in the Far North.*

The production of ferrous metals will not increase in volume, but in the 11th Five-Year Plan there will be important improvements in the assortment of rolled products, their quality will improve, and the industry's fixed capital will grow on an up-to-date technical basis.

Zapsib's source of iron ore has remained unstable up to the present time. By and large it is furnished concentrates of Korshunovo ore and partly

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* "Razvitiye narodnogo khozyaystva Sibiri" [Economic Development of Siberia], Novosibirsk, 1978, pp 318-319.

Lisakovsk, and it also obtains raw materials from other regions: specifically, in 1978 it received 1 million tons of pellets of Kursk ore. Not all the iron ore delivered to the plant is of high quality, which particularly applies to the Lisakovsk phosphorite ores. For a long time there has been discussion of undertaking commercial development of the deposits of high-grade magnetite iron ores of the south and southeast of Altayskiy Kray, above all Beloretskiy and Inskoy. The rail line from Pospelikha to the Beloretskiy-Inskoy Mining and Ore Dressing Combine will presumably be built in the near future; this will provide the necessary preconditions for beginning exploitation of both iron ore deposits. The Kholzunskoye deposit of magnetite iron ores, which is located in the Gorno-Altayskaya Autonomous Oblast, bordering on East Kazakhstan, could be of commercial interest. At the present time it is undergoing geological-economic study; the feasibility of commencing commercial development of this deposit will depend on the results of that study.

The south of West Siberia is gaining more interregional importance for its coke-chemical production, which is part of ferrous metallurgy. The first phase of the Altay Coke and Chemical Combine, which is being built in the worker settlement Zarinskaya, not far from Barnaul, will go into operation. Its capacity (the combine's second phase is to be activated in the 12th Five-Year Plan) will make it one of the largest coke and chemical enterprises in the country.

More than 60 percent of the machinebuilding output of the eastern zone of RSFSR is produced in the south of West Siberia, and only 25 percent remains in the region, meeting its needs at a level of 15-16 percent. The situation could improve through development of those fields of machinebuilding whose products the region's industries will be feeling a rapidly growing need for. The reference is to production of equipment for the petroleum and gas industry, the coal industry, the metallurgical industry, the chemical industry, the timber and lumber industry, the wood manufacturing industry, the electrical power industry and road construction.

Building a sufficiently large machinebuilding industry in the east of the republic to supply equipment to developing industry will take a long time. In the 11th Five-Year Plan only partial measures can be accomplished. It must moreover be borne in mind that recently work has been done to respecialize a number of machinebuilding enterprises in the European regions of the country and the Urals to produce products needed by Siberia and the Far East, which undoubtedly will yield favorable results, but will not diminish the severity of this problem. Specific research showed that development of machinebuilding in the east of the republic for its own needs is economically justified. Moreover, it has been proven in practice that a wide variety of machines and machinery which have not only a national, but even a world reputation and are exported to many foreign countries can be successfully produced here.

It would be wise to develop machinebuilding first in Altayskiy Kray. In Kemerovskaya Oblast principal attention will be concentrated over the next two or three 5-year periods on the principal industries--the coal industry, the metallurgical industry, and the chemical industry, as well as on eliminating the lag of the construction and building materials industry, thermal electric power production, and the infrastructure of the nonproductive sphere.

In Novosibirskaya Oblast technical reconstruction of enterprises in machine tool building and instrumentmaking and enterprises for production of electrical, radio and electronic and automation equipment will assume particularly great importance in this period. In the very near future the manufacture of high-capacity metal-cutting machine tools, forging and pressing equipment and automatic production lines with programmed control should increase substantially here, and there is to be expansion of the production of tank trucks for transport of petroleum products and production of products used in more than one industry and throughout the entire machinebuilding industry. Performance of these measures limits the possibilities of developing the machinebuilding industry in Kemerovskaya and Novosibirskaya oblasts on the basis of new construction in the near future.

The prerequisites for solving this problem are more favorable in Altayskiy Kray. Here a number of enterprises of the industry are also to undergo reconstruction, but the kray still has a labor supply and industrial sites located at points of intersection of rail lines and waterways that make it possible to build up major industrial centers. Machinebuilding will become the most important industry in which the kray specializes and with which prospects for development of its productive forces are most closely bound up.

The location of the south of West Siberia in the basin of the upper flow of the Ob' limits growth in the region of the capacities of the chemical industry for production of intermediates. The leading centers of the industry--Kemerovo and Barnaul--are related to one another in their production technology. The Kemerovo Chemical Complex, where the entire production of ammonia, nitrogen fertilizers, synthetic resins and plastics, synthetic dyes and caustic soda is entirely concentrated, occupies first place in the scale of development. The intended reconstruction and expansion of production at a number of enterprises will considerably increase the potential of the chemical industry in the Kemerovo Complex, but a subsequent growth of the industry's capacities through new construction and expansion of existing enterprises could have an adverse impact on the environment.

The same limiting approach in examining prospects for development of the chemical industry is also justified with respect to the city of Barnaul, where this industry is represented by enterprises for production of tires, lampblack, technical rubber and asbestos products and man-made fibers, enterprises which use raw materials and intermediates shipped in. Some of these enterprises are in need of technical reconstruction in order to raise labor productivity and improve product quality. The prospects for growth of the capacities of the chemical industry in Altayskiy Kray are justified only if fuller use is made of its principal natural raw material--the common salt of the Kulunda Lakes. In the 11th Five-Year Plan there is good reason for planning the organization of the production of potassium sulfite--the first in the eastern zone of the RSFSR--on the basis of that source.

Coal chemistry will develop in Altayskiy Kray over the long run as a part of the coke and chemical combine, but on a modest scale, since the projection here is for the coke-gas to be used mainly for generating power in the thermal electric power station. To a limited extent this industry will continue to exist at the coke and chemical enterprises of the metallurgical plants of the Southern Kuzbass as well.

Large-scale development of coal chemistry is possible in the more remote future on the western flank of the Kansk-Achinsk basin in connection with solving the problem of power-chemical processing of Kansk-Achinsk coals by burning them in magneto-hydrodynamic generators in which the thermal energy will be converted to electric power. This process is now in half-scale operation.*

Among the branches of material production to round out the complex we should identify first of all the building materials industry and construction industry, i.e., the material and technical base of construction. In the near future the material and technical base of construction in the south of West Siberia needs to be developed at a higher pace than previously. It is an important task to improve the qualitative indicators of the material and technical base of construction--improved strength of reinforced concrete, extensive use of heating elements in roof slabs, of panels, of facing products, of lightweight porous and high-strength fillers, of dressed rock products, of finishing materials made from marble and granite, of decorative and acoustic panels, and of polymer materials. Scrap and waste of mining and metallurgical enterprises and power stations, which are practically inexhaustible in the south of West Siberia, should also be used for structural purposes. Conversion of construction to industrial methods is an acute problem in the region.

The electric power industry of the south of West Siberia is faced with the tasks of a further enlargement of capacities for generation of electric power and thermal energy. Alleviating the existing strain on the power budget and satisfying the additional needs of the developing economy can be achieved in the near future primarily by expanding existing thermal electric power stations, most of them operating as part of the Siberian Unified Electric Power System. Preparatory work has been undertaken toward construction of the Krapivinskaya Hydropower Station on the Tom River, which would have a capacity of 300,000 kw. It would improve the hydrological regime of the Tom--the Kuzbass' principal waterway.

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* Chirkov, Yu., "A Variant for the 'Sibir'' Project," SOTSIALISTICHESKAYA INDUSTRIYA, 3 September 1978.

Formation of a new electric power complex on the western flank of the Kansk-Achinsk basin is planned in the more remote future; because of the inexpensiveness of the electric power it would become the basis for building energy-intensive industry there. It is possible to make some progress along those lines in the 12th Five-Year Plan.

Such industries as light industry, the food industry, the timber and lumber industry, and wood manufacturing also perform the functions of rounding out the complex in the south of West Siberia in that they produce products primarily for local consumption, though some of the subindustries in this group do manufacture products for consumption outside the region. These include production of cotton, melange, curtain tulle, porcelain and butter and cheese. The first two types of production operations, which arose in Barnaul back before the war, were built in order to meet the needs of Siberia, but most of the products they produced were shipped to the European regions. This situation has persisted to a considerable extent even up to the present in spite of the altered pattern of local demand. Consequently, the task consists of reorienting sales toward the Siberian consumer. Curtain tulle production, built in the postwar period at Gorno-Altaysk, was oriented toward shipment of products to the European regions of the country though there was an acute shortage of them in Siberia. This orientation should also be changed to the advantage of the Siberian consumer.

Because some of the productive capital of the cotton and melange combines is physically worn out and obsolete, they are to undergo technical reconstruction in the near future, which will enlarge the volume of production somewhat. But there are no foundations for further extensive development of light industry in the south of West Siberia. It is better to ship in products of the specialized enterprises of the European regions of the country in view of the negligible share of shipping costs (between 1 and 5 percent) of the value of the product at the place of consumption, the fact that its high quality is guaranteed, and that the reaction to altered demand will be responsive. The supply of female manpower would be better employed in the social infrastructure; the steady rise in its level has great importance.

The favorable prospects for development of meat and dairy animal husbandry in the Barabinskaya Forest Steppe and in the floodlands of the Ob' River create the prerequisites for enlarging capacities of meat and cheesemaking enterprises through technical reconstruction of existing refrigeration installations and construction of new ones so that they have up-to-date equipment for processing milk.

Major steps are to be taken in the south of West Siberia to increase crop yields and the productivity of animal husbandry, to improve product quality and to raise the technical-and-economic indicators of production. But since possibilities of employing additional land in the region for growing crops have almost been exhausted, and the labor supply is limited, the most optimum use must be made of the existing plowland thanks to intensification of production, a rise in the equipment-to-land ratio, improvement of technology, application of manufactured fertilizers to the soil in accordance with standards, and adoption of promising varieties of crop plants. Because of the unstable nature of agriculture in the Kulunda Steppe, which is the region's principal cropping zone, its high dependence on local climatic conditions and on the influence of dry winds from Kazakhstan and cold winds from the Arctic, it becomes very important to carry out reclamation projects, to erect protective belts, to practice snow irrigation, and to make extensive use of implements for tilling the soil that do not have a moldboard.

Animal husbandry will still have the leading role in the makeup of the makeup of the agriculture of the south of West Siberia, since cropping, which requires larger capital investments to overcome the difficulties of the natural conditions, is the less efficient branch. Creation of a stable source of livestock feed and improvement of the conditions for maintaining animals in the wintertime would ensure a higher level of animal husbandry. Performance of these tasks have been projected over a comparatively long period in the future and can be only partially accomplished in the 11th Five-Year Plan.

In Altayskiy Kray construction will continue on major reclamation projects--the Kulunda Canal, the Altay irrigation system, the Gilevskoye reservoir, and the Charyshskiy water supply system, which will facilitate a further rise in the region's agriculture.

Even though the transportation system of the south of West Siberia is far better developed than in the other regions of the eastern zone of the RSFSR, the problem of raising its level further is still urgent, as indeed it has been. This applies first of all to strengthening the rail connections of the Kuzbass with the west, since in their present condition they are not adequate to carry out the coal, metal and chemical products of the Kuzbass. Carrying capacity is to be increased in certain sections of the main lines of the Novosibirsk rail junction--one of the largest in the country. In Altayskiy Kray there is a need to expand the Barnaul rail junction and to increase the carrying capacity of the branch from Barnaul to Biysk. It is urgently important to build the railroad to Gorno-Altaysk. The absence of rail connections in the Gorno-Altayskaya Autonomous Oblast is holding back development of its productive forces and exploitation of local natural resources whose production is efficient--metallic minerals, marbles, etc.

The condition of other branches of transportation--highway, river and air--also await improvement because of the increased freight and passenger traffic. A number of sections of main highways are in need of reconstruction, in particular the Chuyskiy Route, which is the connection between the USSR and Mongolia, and also for construction of new hard-surface highways to provide connections to the deep interior. Riverports in the region's principal industrial centers need improvement of their technical condition--a rise in the level of complete mechanization of cargo handling and improvement of traffic flow capacity.

The problems of economic development of the south of West Siberia, as indeed everywhere, are inseparably bound up with social problems--raising the standard of living of the population and its material and cultural well-being. Over the past 10-15 years the rise of the material and cultural well-being of the population has been achieved to the highest degree in the major industrial centers of the region, which is where capital outlays for the social-residential infrastructure have mostly been made. It is an important task in the future, along with a further rise in the level of the social-residential infrastructure in large cities, to ensure a considerable growth of this infrastructure in small and medium-sized cities and worker settlements through industrialization, enhancement of the role of cultural centers, the location of scientific research organizations in them, and so on. Industrialization of small urban settlements which have the necessary foundation for this would also bring about especially important changes, and this would coincide with the task of improving the geographic organization of the region's economy. Within the region there are urban settlements located at points of intersection of main rail lines and waterways which have industrial sites of substantial size that do not require high outlays for development and which are of great interest for large-scale industrial construction and civil engineering. Paramount among them are the following: in Altayskiy Kray--Kamen'-na-Ob', Tal'menka, and Zarinskaya; in Novosibirskaya Oblast--Toguchin and Tashara; in Kemerovskaya Oblast--Yurga, Mariinsk and Yaya. At each of these points a large industrial center and large city could be organized with a population between 100,000 and 200,000-250,000. Performing this task would make it possible to complete the industrial development of existing large-scale industrial centers of the region--Novosibirsk, Novokuznetsk, Kemerovo, Barnaul, principal attention being paid to their social amenities and also to increasing the significance of scientific and cultural nuclei, for which there is every basis because the region's highly qualified personnel are concentrated there.

Obstacles to implementing this principle have so far been, first, the desire of sectoral ministries and departments to locate their new construction projects in large industrial centers and cities that already exist, where they are relieved of a number of additional outlays to develop new areas, and second, concentration in those centers and cities of the bulk of the capacities of construction facilities. But if instead of "piecemeal" location of new construction projects, we look to the formation of industrial parks, then it will be a question of the shared participation of ministries and departments in building common utility installations and communications and the production and social-residential infrastructures, which will reduce the costs of each of these organizations correspondingly. Opposition to large-scale industrial development of small and medium-sized cities and worker settlements of the region because they lack construction facilities is not a convincing position, since they are not adequate to that task even in the large industrial centers that already exist. As experience has shown, these construction facilities have to be built from scratch. When construction of Zapsib was organized in Novokuznetsk, which in the mid-fifties was a sizable industrial center, a specific construction capability also had to be built for that purpose, as was also the case in organizing construction of the Altay Coke and Chemical Combine in Zarinskaya, where that construction project marked the very beginning of industrial development. Construction of the chemical complex at Barnaul in the sixties required organization of an adequate construction capability, since the city, in spite of the considerable industrial development it had already attained by that time, did not have unused potential in the construction industry. A similar situation is now taking place with development of the coal resources of Yerunakovskiy Rayon in the Kuzbass.

It is still difficult to predict exactly which new industrial centers will spring up in the south of West Siberia over the long run and what will be their specialization in production. Judging by preliminary analyses, it seems to us quite probable that Kamen'-na-Ob' and Tal'menka would be among them as centers of machinebuilding, Yurga, which would specialize in the production of equipment for the coal and mining industries, and Mariinsk, which would specialize in the production of metallurgical equipment and aluminum. The latter is justified by the inexpensiveness of electric power because of the use of Kansk-Achinsk coal.

A serious shortcoming in the geographic organization of the economy in the south of West Siberia is the weak industrial development of zones gravitating toward the large industrial centers, which is holding back formation of cluster systems of settlement. In such systems the shortcomings of large cities--air and water pollution and overloading of municipal and inner city transport--are not so pronounced, conditions as to workplace location are improved, and a higher level of education and cultural and consumer services is ensured inhabitants of small settlements. However, there is a pronounced predominance of monocentric agglomerations in the region, and in this respect it is lagging behind the country's other advanced industrial regions. Correction of this shortcoming is a task of multiannual planning. It has priority importance for the Novosibirsk cluster system of settlement, which includes more than 20 urban settlements. In some of them it would be wise to locate affiliates and shops of the city's machinebuilding enterprises and independent plants of machinebuilding and other industries.

The problem of environmental protection has great economic and social importance to the south of West Siberia. It is particularly urgent in the Kuzbass, where heavy industry is concentrated. The amount of dust, soot, fluorine and sulfur compounds, nitrogen oxides and other toxic substances contained in the air of the large cities of the Kuzbass exceeds the standards. Various toxic substances are being discharged into the basin's bodies of water. In 1973 the RSFSR Council of Ministers adopted decisions on measures to prevent pollution of the Tom River watershed with untreated effluents and the air basin of the cities Kemerovo and Novokuznetsk with industrial emissions.*

Under those decrees important environmental protection measures have been carried out in the Kuzbass. Treatment installations have been built at a number of open-cut and underground coal mines and at chemical enterprises of the Kemerovo Complex; water recycling systems have been built at Zapsib and the aluminum and aniline dye plants; and emissions that pollute the air have been eliminated at most boiler plants. In Novokuznetsk an institute has been organized devoted to the overall problems of industrial hygiene and occupational diseases, and in Kemerovo a sectoral problems laboratory has been set up. A regional state inspectorate is monitoring the operation of gas purification and dust-catching installations. But these measures for environmental protection of the Kuzbass have been carried out only partially, and a number of treatment installations are not functioning effectively enough. The fight against pollution of the natural environment of the Kuzbass is not temporary, but permanent in nature.

Novosibirsk and Barnaul need environmental protection measures. In Novosibirsk there is a high concentration of hydrocarbons and certain other toxic substances in the air. The principal sources of pollution are the enterprises of ferrous and nonferrous metallurgy, thermal electric power plants and boiler plants. In Barnaul the air is also polluted. The principal sources of pollution are the lampblack plant, the man-made fiber plant, thermal electric power plants and boiler plants.

The river Ob' is polluted near Novosibirsk and Barnaul. There is also a need to ensure a thrifty attitude toward the timber resources of the mountains of Gornyy Altay and Kuznetskiy Alatau, whose improper exploitation could be harmful to the water network and could cause soil erosion on areas located in the foothills and the plains. For decades timber has been cut in excess of the calculated felling of timber in the Gornaya Shoriya, which has resulted in low water on the Tom River and has interfered with the water supply of the Kuzbass.

Recently a healthy tendency to reduce the volume of timbering in the basins of the Biya and Katuna has been observed: their confluence gives rise to the Ob'. Calculations show that timbering in the mountains of this region is less economical than shipping it in from neighboring parts of Siberia. In future there is a need to adopt an orientation to halt timbering here in every way and to restrict it to the felling needed for normal care as part of forest management.

Development of the coal industry in the Kuzbass has made it necessary to bring land back under cultivation in areas where the coal is mined, i.e., to utilize the soil cover it has destroyed. This is also a natural conservation measure and will be for all practical purposes a permanent feature in the Kuznetsk basin.

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* Yurov, G., "Five Floods From the Sea," PRAVDA, 1 July 1979.

At the present time only one generally recognized regional industrial complex--the Kuzbass--is in operation in the south of West Siberia. Its boundaries coincide with the boundaries of the Kuznetsk coal basin, which occupies one-fourth of the area of Kemerovskaya Oblast. It is distinguished by the extremely high industrial saturation of the area. It has 64-fold more industrial productive capital per square meter and 50-fold more gross industrial output than Siberia as a whole. In the Kuzbass there are industrial centers and cities located at very short intervals from one another, the largest of them being Novokuznetsk, Kemerovo and Prokop'yevsk. Only the Donbass is equal to the Kuzbass in its level of urbanization.

In the nineties of this century we can expect formation of a second TPK in the northeast of Kemerovskaya Oblast: it would specialize in energy and industry and would provisionally be called the Itat--Mariinsk TPK. It would be based on the coal industry, the mining and beneficiation of the coals of the western flank of the Kansk-Achinsk basin. By analogy with the central part of Krasnoyarskiy Kray, there are plans here for supercapacity thermal electric power stations generating cheap electric power and heat, which would lead to development of power-intensive and heat-intensive production operations. Assuming that some of the local coal would go through electrochemical processing, the necessary prerequisites will be created for building chemical production operations. As a part of the TPK Itat will apparently perform the function of an organizational and technical center of the coal industry. The reason for this is that in addition to the Uryupskiy coal deposit the Itat and Barandat deposits will also be developed, and relative to them Itat has the most advantageous geographic location. Mariinsk, as we have already noted, could become a distinguished center of machinebuilding and the aluminum industry. The area that would be occupied by the possible TPK is still very little developed as yet.

In that same time frame of the end of the current century the configurations of a third TPK in the south of West Siberia are also being sketched out--the East Altay TPK, which would include the existing industrial centers of Barnaul, Novoaltaysk, Rubtsovsk and Biysk, and the new ones--Zarinsk, Kamen'-na-Ob', and Tal'menka, as well as the agriculture developed there, though it would have a subordinate role to play in the overall economy. The leading sector of this TPK would be machinebuilding with a diverse configuration; while maintaining its present nationwide importance, it would at the same time become one of the principal centers for retooling the economy of the eastern zone of the RSFSR.

Development of intersector and regional industrial complexes in the south of West Siberia will tend to raise the overall level of the region's economic integration and efficiency.

THE KUZBASS REGIONAL INDUSTRIAL COMPLEX (TPK)

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 122-128

[Paper by A. I. Shrago, Laboratory of the Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences, Kemerovo]

[Text] The boundaries of the Kuzbass Regional Industrial Complex coincide with those of Kemerovskaya Oblast. The oblast's area represents 2 percent of that of Siberia. It accounts for 14 percent of Siberia's population, 5.8 percent of the grain production, 6.1 percent of the meat production, 9.3 percent of the output of the machinebuilding and metal manufacturing industries, 17.5 percent of the electric power generated, 25 percent of the output of chemical products, 67 percent of the coal mined, about 70 percent of the steel and 100 percent of the pig iron. Kemerovskaya Oblast's share of national production is 3 percent of the electric power generated, 7 percent of the synthetic resins and plastics, 7.4 percent of the rolled products of ferrous metals, 8.1 percent of the steel smelted, 9.4 percent of the pig iron, 20.5 percent of the coal mined, and 30 percent of the production of caprolactam.

The Kuzbass TPK was formed in the initial period of socialist industrialization as the eastern flank of the Urals-Kuznetsk Combine. It delivered coal to the Urals and received iron ore. Coal is at present being delivered to the Urals as before, but the Kuzbass is receiving its ore from deposits in Siberia.

Over a 13-year period (1966-1978) the volume of industrial output in the Kuzbass has grown 2.2-fold and now amounts to about 17 percent of the gross output of Siberia's industrial sector. We should note here the sizable growth of the food industry and especially light industry. The latter is related to activation of the silk fabric combine in Kemerovo, the worsted fabric combine in Leninsk-Kuznetskiy, the footwear factory in Kiselevsk, the porcelain and earthenware plant in Prokop'yevsk and other enterprises. The figures in Table 1 show structural shifts in the development of the industrial sector.

Table 1. Structure of Production (On the Basis of Gross Output), in percentage

Industry	1965	1978	Changes in Relative Share Between 1965 and 1978, ±
Industrial sector as a whole	100.0	100.0	100.0
Fuel (coal)	36.8	27.8	-9.0
Ferrous metallurgy	17.5	16.8	-0.7
Nonferrous metallurgy	4.3	2.9	-1.4
Chemical industry	6.2	10.6	+4.4
Machinebuilding and metal manufacturing	9.0	13.5	+4.5
Total for the industries representing specialization	73.8	71.6	-2.2
Electric power industry	5.0	4.7	-0.3
Timber, lumber and woodworking	3.4	2.5	-0.9
Building materials industry	3.8	3.4	-0.4
Light industry	2.8	7.0	+4.2
Food industry	10.3	8.5	-1.8
Other industries	0.9	2.3	+1.4
Total for auxiliary and service industries	26.2	28.4	+2.2

The growth of the industrial sector in the Kuzbass TPK has been based on enlargement of production capacities. In 1978 the fixed capital of the industrial sector had grown 2.3-fold over 1965, the growth having been 1.9-fold for the fuel industry, 1.8-fold for the electric power industry, 3.4-fold for ferrous metallurgy, 2.3-fold for the chemical industry and 3-fold for machinebuilding and metal manufacturing. A still larger growth of fixed capital (6.7-fold) took place in light industry. The existence of large assets in operation makes it important that they be better utilized thanks to intensification of all branches of production.

Between 1966 and 1978 the number of industrial production personnel grew 1.2-fold in the industrial sector as a whole, 1.2-fold in ferrous metallurgy, 1.5-fold in the chemical industry, 1.5-fold in machinebuilding and metal manufacturing as well, and only in the fuel industry did it drop 2 percent, while in the electric power industry it remained at the 1965 level. At the same time a substantial growth of the capital-worker ratio was obtained in all industries. The capital-worker ratio increased 1.9-fold in the industrial sector as a whole, more than 3-fold in light industry, nearly 2.9-fold in ferrous metallurgy and between 1.5- and 2-fold in other industries.

The rise of labor productivity has been an important achievement. Over the period being analyzed labor productivity (based on gross output) grew more than 1.7-fold in the industrial sector as a whole, 1.5-fold in the fuel industry, 2-fold in the electric power industry, 1.6-fold in ferrous metallurgy, 2.4-fold in the chemical industry, 2.1-fold in machinebuilding and 2.8-fold in light industry.

We should note a certain reduction in the growth rates of the volume of production in Kemerovskaya Oblast in recent years (Table 2). The very fast development of the petroleum industry in Siberia (Tyumenskaya and Tomskaya oblasts) and the sizable growth of the electric power industry in Krasnoyarskiy Kray and Irkutskaya Oblast have been accompanied by a drop in the Kuzbass' relative share in the output of the fuel industry and the electric power industry.

Table 2. Average Annual Growth Rates of Gross Output and the Relative Share of the Kuzbass in Siberia's Industrial Output

	Average Annual Growth Rates of Output				Relative Share of Kuzbass in Siberia's Output	
Industry	1966-1970	1971-1975	1976-1978	1978/1965, %	1965	1978 app.
Industrial sector as a whole	6.70	5.7	3.40	202	21.5	17.0
Fuel industry	2.85	3.9	2.50	150	64.0	35.0
Electric power industry	4.20	10.1	9.45	189	23.5	19.0
Ferrous metallurgy	7.10	4.1	2.50	191	73.3	76.5
Chemical industry	11.70	10.8	5.30	339	18.0	25.0
Machinebuilding and metal manufacturing	10.50	8.6	6.50	260	9.6	9.0

In speaking of the important achievements in development of the oblast's productive forces we cannot but note certain shortcomings as well. First among them might be the appreciable lag of the rise of labor productivity behind the capital-worker ratio, especially in light industry, the coal industry, the food industry and ferrous metallurgy. In most industries and the industrial sector as a whole there has been a noticeable drop in the output-capital ratio, which is evident from the following figures: in 1978 the level of the output-capital ratio was 79 percent of the 1965 level for the industrial sector as a whole, 75 percent for the fuel industry, 54 percent for ferrous metallurgy and 77 percent for machinebuilding and metal manufacturing.

For all the importance of the coal industry, we must take into account that it is one of the components of the national economic complex of the Kuzbass and above all a member of the complex of heavy industries. The Kuzbass TPK took shape as a coal, metallurgical and chemical complex. At present all the conditions exist and there is the objective feasibility for developing it as a coal, metallurgical, chemical and machinebuilding complex. In that complex the proportions of the coal industry and machinebuilding industry should increase first of all.

We should also note among the shortcomings failure to fulfill plans by a number of industries, by agriculture and by capital construction. In just 3 years of the 10th Five-Year Plan coal miners have been short 5.1 million tons of coal, and in ferrous metallurgy the plan has not been fulfilled for the smelting of pig iron or the production of steel and coke. Certain enterprises in heavy machinebuilding, the chemical industry, the electrical equipment industry, the textile industry and other industries are lagging behind the targets of the 5-year period. Sovkhozes and kolkhozes have fallen short in deliveries to the state by 473,000 tons of grain, 60 tons of potatoes, 63,000 tons of vegetables, 22,000 tons of meat, and 8,000 tons of milk, which has affected the supply of foodstuffs to the workers of the Kuzbass.

Over the 3 years the oblast's construction workers have failed to activate capacities for mining 2.6 million tons of coal, for producing 675,000 tons of manufactured fertilizers, and for producing products of machinebuilding worth 12 million rubles. The plan for construction of nonproduction facilities was fulfilled at a level of only 93 percent. The volume of unfinished construction increases every year.

Among the principal reasons for nonfulfillment of plans in various sectors we might put the following first: a) the lag in activation of new capacities in construction and in reconstruction and expansion of existing enterprises; b) the drop in efficiency of utilization of fixed capital; c) the drop in growth rates of labor productivity; and d) the shortage of personnel.

The coal industry is the oblast's leading industry. There are two coal basins located within Kemerovskaya Oblast: all of the Kuznetsk basin and a part of the Kansk-Achinsk basin. According to recent calculations of the West Siberian Geological Administration the possible output of coal mining in the Kuzbass is estimated at 550 million tons. In that case it would be able to make up a sizable portion of the deficit of the European part of the USSR by delivering there 220-250 million tons of coal for heat and power, which is equal to the coal mined in the Don basin at full utilization of its capacity.

A specialized coal-hauling railroad will evidently have to be built in the long run to carry that amount of coal to the regions of the Volga Valley and the Center. In the immediate future the most efficient and reliable solution of this problem might be to specialize the Central Siberian Main Rail Line so that it would be mostly carry coal from Kuznetsk.

In view of the growing role of coal in the USSR fuel balance, the problem of increasing the efficiency of coal mining in the Kuzbass is becoming ever more important. In the Kuzbass coal is mainly mined underground by machine. Average output is 79-80 tons per miner (per month); at advanced mining enterprises this rises to 120-150 tons. Future technical progress will make it possible to raise the output in new underground mines to 200-220 tons or even more.

Open-cut coal mining is more efficient. With present equipment output at the open-cut coal mines of the Kuzbass averages 250 tons per worker employed in mining, and this includes an output of 350-400 tons at advanced enterprises. The new cyclical-flow technology of open-cut coal mining is being prepared for industrial introduction; it would make it possible to raise the output to 550-600 tons per month per worker employed in mining, and transition to flow-line technology would raise it to 600-800 tons.

Underground hydraulic mining is a new technological direction. In 1977 output per worker was 154 tons for underground hydraulic mining, including 282 tons at No 2 hydraulic mine of the Yubileynoye Mining Administration. At the institute VNIIGidrougol' [All-Union Scientific Research, Planning and Design Institute of Hydraulic Coal Mining] the basic elements have been worked out for the design of a hydraulic underground mine with an output of 400-500 tons per worker. The scientific elements for building a hydraulic underground mine with an output of 800-1,000 tons are under consideration.

If the production cost of coal mined underground by machine is taken as 100 percent, then it is 65 percent for open-cut mining and 64 percent for underground hydraulic mining (in 1978). An important advantage of hydraulic mining is the lower metal intensiveness (between one-half and one-third as great, and even between one-fourth and one-fifth as great with respect to the basic equipment) as compared to underground mechanical mining. Operating losses of coal in hydraulic mining are at the level of the average losses for the basin. Moreover, the hydraulic method can be used to work those sections which are not in practice feasible for underground mechanical mining. The social advantages of the hydraulic method are the absence of occupational disease among miners--pneumoconiosis--and the lower accident rate as compared with mechanical underground mining.

Improvement of the technology and increasing the relative share of hydraulic mining and also of open-pit coal mining should be regarded as the main directions for intensification and consequently for increasing the efficiency of coal mining in the Kuzbass.

Since about 40 percent of the coal reserves of the Kansk-Achinsk basin, which have a practical interest to the national economy, are located within Kemerovskaya Oblast, an important factor in intensification of the coal industry is also to develop the western part of this basin, above all the Itat and Barandat deposits, which are located in Kemerovskaya Oblast. The production cost of coal at those deposits might be only half as great as at existing open-cut mines.

In the 11th Five-Year Plan coal mining is to undergo a substantial growth in the Kuznetsk basin, including the production of coking coals. Development of the Uryupskiy deposit by building open-cut mine No 1 should begin in that portion of the Kansk-Achinsk basin located in Kemerovskaya Oblast. Provision should be made to increase the relative share of open-cut mining to 40 percent of total coal mining and the share of the hydraulic method to 8-10 percent. It is accordingly advisable to undertake construction of the first hydraulic underground mines with an output of 400 tons per worker per month, to begin construction of an underground mine with a new technical-and-economic level with an average output per miner of 800 tons per month, and also to convert a group of underground mines from the underground mechanical technology to hydraulic coal mining. In Yerunakovskiy Rayon coal mining needs to be increased to 10 million tons per year in the 11th Five-Year Plan.

The second industry in which the Kuzbass TPK is specialized is ferrous metallurgy. While there was a sizable growth in the capital-worker ratio (almost threefold) the output-capital ratio in 1978 was only about 60 percent of the 1965 level, which is because technical-and-economic indicators dropped off: coke consumption per ton of conversion pig iron has risen, the output of steel per square meter of open-hearth furnace has dropped, and the coefficient of utilization of the effective volume of blast furnaces has dropped, etc.

The principal tasks of ferrous metallurgy in the Kuzbass are as follows: to increase the volume of production, to expand the assortment and to improve the quality of the product. Development and intensification of ferrous metallurgy are bound up with reconstruction of the Kuznetsk Metallurgical Combine and completion of construction of the West Siberian Metallurgical Plant. At the Kuznetsk Combine intensification depends greatly on the following factors: in blast furnace production to utilize casinghead gas, which was made available in 1978; in steelmaking to replace the open-hearth process by converters and also to organize electric steelmaking, and in rolling to replace the old rolling mills with mills that have higher output. At the same time construction of the department for heat treatment of rails needs to be completed to increase the quality of the finished product.

At the West Siberian Metallurgical Plant the fourth blast furnace is to be prepared for construction, which will begin after 1985. At the Zapsib production is being intensified by developing converter production, by building the heavy-sheet 3600 mill and by preparing for construction of the thin-sheet 2000 mill.

Whereas the capital-worker ratio of the Kuzbass' chemical industry rose 1.6-fold between 1966 and 1978, it managed to raise the output-capital ratio nearly 40 percent. Up to 1985 it is advisable for the chemical industry to develop exclusively by raising the efficiency of utilization of the existing production potential. Environmental pollution will be the principal factor limiting the quantitative growth of production. Accordingly the main direction for intensification and for increasing production efficiency is to convert enterprises to using casinghead gas as a raw material instead of coke gas and coke. This will make it possible to increase the volume of production 2.5-3-fold, to raise labor productivity 2.5-fold and to cut in half the production cost of ammonia.

A new component--the coal-chemical industry (production of liquid products and aromatic hydrocarbons)--may make its appearance in the more remote future in the Kuzbass' chemical complex. It is important in the 11th Five-Year Plan to expand research in the Kuzbass on the problems of using coal as a raw material to obtain heavy chemicals.

Development of the coal and metallurgical complex and other economic spheres is imposing definite requirements on local machinebuilding and metal manufacturing. Sizable projects have recently been carried out for reconstruction of existing enterprises and for introduction of new equipment, including machine tools with digital program control, automatic and flow production lines, and progressive new manufacturing processes. But along with achievements in the development of machinebuilding and metal manufacturing there are also a number of shortcomings. Utilization of fixed productive capital has fallen off: the output-capital ratio has dropped, and in 1978 represented 76 percent of the 1965 level. Specialization and cooperative arrangements have developed poorly, and as a consequence nearly all the oblast's enterprises are producing castings, forgings, stampings, a large portion of tools, all their jigs and fixtures for themselves, and are also repairing their own equipment.

As research has established, it is feasible to build in Siberia specialized research and industrial centers in machinebuilding which would consist of the head enterprises, design offices, pilot production facilities and specialized educational institutions. To be specific, it might be possible to organize in Kemerovo a research and industrial center of chemical machinebuilding, and one in Mariinsk for mining machinebuilding. As before it is an urgent task to intensify production specialization and industrial cooperation and to create enterprises to manufacture products used in more than one industry and for centralized repair of equipment.

Kemerovskaya Oblast's agriculture is characterized by certain specific features. First of all, nearly all the farming zones in the oblast are located around cities; second, the relatively small area of farmland and plowland (1.5 million hectares, or 5.5 percent of the area of plowland in Siberia) and the highest share of the urban population (86 percent) in Siberia make it a necessity to increase the level of specialization of agriculture in the production of those products whose transport presents definite difficulties or is impossible (whole milk, vegetables, potatoes, dietetic foods, etc.).

Certain work has been done along these lines in recent years: areas planted to potatoes and vegetables have grown, vegetable growing has begun the conversion to irrigation, industrial-type egg production is developing at a high pace, and the Chistogorskiy Hog-Raising Complex with a capacity to fatten 108,000 head per year and a number of dairy complexes have been built and put into operation at full capacity. But we continue to observe certain adverse trends: the low level of yields and fluctuation of the size of the harvest from year to year are tending to undermine the source of feed and fodder for livestock raising, to reduce the production of milk and meat, to delay the return on capital outlays and to raise production costs. The seriousness of the situation is compounded by the shortage of skilled personnel in rural areas.

Increasing the efficiency of the oblast's agriculture is inseparably bound up with its consistent and purposive intensification. In grain growing this means a transition to the grain-forage type of production which involves large applications of chemical fertilizers and new varieties of crop plants, supplying sets of high-capacity machines to farms, above all equipment for harvesting and processing grain, and the building of up-to-date storage facilities. Intensification of vegetable and potato growing calls for conversion of these branches to irrigated land, development of hothouse vegetable growing, and solving the problem of mechanizing labor-intensive processes in the raising of crops and the gathering of the harvest. In animal husbandry dairying and the raising of hogs for pork need to be put on an industrial basis at a pace faster than in the other oblasts of Siberia, the production of livestock feed needs to be intensified, and a stable source of livestock feed and fodder needs to be created.

The priority tasks which should be performed by the oblast's agriculture by the end of the 11th Five-Year Plan are as follows: a sizable (1.5-2-fold) rise in the yield of grain and fodder crops, the building up of large emergency reserves of grain forage and coarse feeds capable of covering the shortfall in bad years, virtually complete mechanization of dairying operations, development of interfarm specialization and cooperation in the production of food, and agroindustrial integration, above all with respect to the products of animal husbandry and vegetable crops.

Rail transport has become one of the bottlenecks in development of the Kuzbass. Kemerovskaya Oblast is a major source of raw materials. Every year railroad workers carry away 260 million tons of freight (coal, metal, cement and other products), which constitutes the bulk of the traffic of the West Siberian Railroad. In recent years there have begun to be disruptions in the regularity of loading and unloading and the movement of trains, and cars have been allowed to stand idle for long periods in excess of the plan. Product delivery dates are not being met, while at the same time sizable amounts of products are accumulating in the storage facilities of enterprises. In 1978 as much as 7 million tons of fuel built up in coal storage areas of underground and open-pit mines and beneficiation mills.

The principal reason for this situation is the lag in development of the material and technical base of the oblast's rail transportation (stations, track equipment, rolling stock and repair facilities). It is, then, a priority task to build a number of rail branches that would strengthen internal connections and also additional outlets to the principal main lines of Siberia.

In recent years there has been a certain increase in the volume of capital investments and activation of fixed capital. The distribution of capital investments has improved somewhat thanks to an increase in the share going for reconstruction, retooling and expansion of existing enterprises (from 52 percent in 1975 to 73 percent in 1978) and for the reequipping of agriculture. At the same time capital construction is becoming more and more of a bottleneck in development of the Kuzbass' productive forces. Many construction organizations in the oblast are regularly failing to fulfill production plans: for instance, in 1978 about 50 percent of construction contractors did not fulfill their plans, the assignment for construction and installation work was fulfilled at a level of only 90 percent. At the beginning of 1978 a large number of construction sites and projects were classified as unfinished construction (including enterprises of the coal industry, ferrous metallurgy and the building materials industry).

In order to speed up the rate of construction and to move up dates for activation of fixed capital it is above all necessary over the next 6-7 years to increase the fixed productive capital of the construction industry 1.6-1.8-fold, including a 2-2.2-fold growth of their machines and equipment; the volume of output of the building materials industry should be increased 1.5-1.7-fold.

Performance of these measures will make it possible to achieve more proportional development of the leading industries of the Kuzbass Regional Industrial Complex.

EXPERIENCE IN MANAGING THE FORMATION OF THE BRATSK--UST'-ILIMSK TPK

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 128-132

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[Text] Experience in the economic development of natural resources in our country has led to development of a particular approach to solving the problems of interaction between projects to be built in regions of new development when a major regional problem is being solved: the ministry or department undertakes to build the industrial or transport-industrial combine, and it provides unified supervision of the entire economy within that area.* Such combines operate within the framework of sectoral management.

In the Middle Angara Valley it has been clear from the very outset of its economic development that in this area it would be necessary to solve the problem of developing the hydropotential and organizing the production of aluminum, the combined use of wood, and the mining and enrichment of iron ore. A particular entity in sectoral management and planning will be interested in performing each of these. That being the case, a different approach is needed to organizing the planning and management of economic development, an approach that differs from building the kind of combine we have indicated.

The commencement of operations involved in the economic development of the natural resources of the southern part of the Middle Angara Valley was made easier by the fact that by the end of 1949 this area had already been connected to the other regions of the country--the railroad from Tayshet had reached the banks of the Angara.

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* Slavin, V. S., "Principal Problems in Raising the Efficiency of Development and Location of the Productive Forces of the North of the USSR," in the book: "Problemy Severa" [Problems of the North], Issue 16, Moscow, Nauka, 1972, pp 25-26.

The builders of hydraulic engineering structures were the pioneers of intensive development of the natural resources in the Middle Angara Valley. The high efficiency of the Bratskaya Hydroelectric Power Station made it competitive with any other station even when outlays related to infrastructural development of the area where it was built were added to the cost.

By contrast with transportation construction, construction of hydropower facilities promotes commencement of intensive development of an area not only because it creates large capacities for the production of electric power (the average multiannual output, for example, of the Bratskaya GES is more than 22 billion kilowatt-hours of electric power), but also thanks to organization of a sufficiently large infrastructure. Construction of a major hydropower facility is impossible without large construction subdivisions that have the necessary production capability and that are capable of an annual output of 70-100 million rubles worth of construction and installation work in the peak period. This cannot be done without creating reliable main land transportation routes to carry the large amounts of building materials and equipment. Construction of a hydropower facility requires provision for reliable power supply by building power transmission lines and TETs. Because of the sizable length of the construction process (as much as 10 years) permanent and comfortable housing and social consumer-service facilities have to be built to house and meet the needs of workers in the peak period of construction. Because of the creation of storage reservoirs, a sizable amount of work has to be done to move existing economic and cultural facilities from the zone of inundation and to rebuild them. Once construction of the hydroelectric power station has been completed, large crews of construction workers become available, along with capacities for production of local building materials, the facilities of the construction industry, and so on (the need for personnel to operate the power plant, taking into account all service areas, is less than one-tenth of the number of workers employed in construction in the peak period). All of this figures as a strong force attracting new industrial projects for location and development in the vicinity of the GES site and in areas gravitating toward it.

In the initial stage of developing the Middle Angara Valley (during the first 4 years) operations related to building the hydroelectric power station were mainly carried out. Because of the specific nature of the peculiarities of hydraulic engineering construction we have noted, the construction organization that was created--Bratskgesstroy--managed in that time to build the 220-kv power transmission line from Irkutsk to Bratsk, to set up the pioneer base for industrial construction and civil engineering, to man the staff of construction workers, and so on. At the same time the decision was taken for all construction in the zone affected by the Bratskaya GES to be turned over to that organization, and to that end it was allowed to build up a single production base for capital construction at an estimated cost of 58 million rubles. Construction of the latter began in 1959. Later, as the anticipated volume of construction and installation work increased, the production base of capital construction was expanded. At the present time the fixed capital of Bratskgesstroy exceeds 0.5 billion rubles. As a general contractor it does more than 400 million rubles of work per year, it produces 130 million rubles worth of building materials, construction fabrications, equipment, gear and fixtures, and so on.

Given the uninhabited nature of the region, the formation of the organizational structure of the construction administration was influenced not only by the principal task for which it was created, but also by the need to develop production and social infrastructures on the necessary scale, since without them it would be impossible to perform its basic and specific function in the uninhabited region. Provision had to be made to meet the full need of subdivisions for electric power, water, heat, sewage treatment, freight transport, and so on. The administration also had to take upon itself the solution of the problems of meeting the needs of the workers for housing and utility services, for trade and food service, for travel to and from work, and so on. In Bratsk the transportation construction workers provided only 6,000 square meters of floor space which could be adapted for housing.

It is a peculiarity of the infrastructure that the rate of activation of the capacities of its individual facilities does not as a rule coincide with the growth of the need for the respective product or service, which creates unused capacity in a number of cases. Its existence made it possible for the administration to undertake to serve small consumers, which on the one hand facilitated their location in the Middle Angara Valley and on the other promoted greater centralization of the infrastructure. At the same time, disproportions between particular types of services frequently occurred when this approach was taken. It was more difficult to correct them because the small consumers were unable to help in developing even those parts of the infrastructure in which there was no idle capacity.

In order to reduce costs of developing the social and production infrastructures, a project calling for a single city was drawn up, and the administration set up to supervise its construction was given the rights of an oblispolkom division. The idea here was to make the work of the administration Bratskgesstroy easier, since it would have to deal with a single client on matters of housing and utilities in Bratsk. But it was not possible to achieve this because of departmental barriers. At present it must deal in Bratsk with 18 customers aside from the administration for its construction.

Commencement of activation of housing and utility facilities in the central part of Bratsk put the problem of their operation on the agenda. The administration for construction of the city had neither the rights nor capabilities for this. Yet the customers did not wish to burden themselves with concern about their operation. They had not set up their own services in advance, nor were they able to organize them in connection with the city council for operation of housing and utility facilities. In order that the housing which had been built would not stand idle, then, they were compelled to carry out this variant: to lease them for operation to the administration Bratskgesstroy, which is now operating more than 85 percent of the leased housing stock. From its own profit it is covering losses amounting to more than 10 billion rubles per year.

At the present time 42.6 percent of the workers on the labor force of the administration Bratskgesstroy are employed in construction and installation work, 22.7 percent are employed in production of building materials and the repair of equipment, 19.1 percent are employed in transportation and communications, and 15.6 percent are serving the systems of water supply, sewers, heat and power distribution networks, housing management and utilities, and so on. Moreover, the labor forces of subcontractors and worker supply administrations are closely associated with the work of the administration, since they are involved in performing all the operations of the administration. As of 1 January 1979 the total labor force of subcontracting organizations was 17.2 percent of the labor force of the administration, and that of worker supply administrations was 21.6 percent. These figures graphically confirm our idea that in the range of tasks it performs the administration Bratskgesstroy has gone beyond the boundaries set by the interests of construction.

Is this a bad thing or a good thing? In the initial stage of development this kind of unification of these functions might still be acceptable because of their small scale. It made it possible to solve very responsively the problems of building the foundation of production, staffing the labor force, and furnishing the population housing, the services of building social and consumer service facilities, trade, food service, and so on. But now housing and municipal service management does not have its own production facilities for current and major repairs, nor are common carriers developing as they should in highway transportation. At the same time performance of these functions, because their scale has increased considerably and their complexity has grown as a consequence, are more and more tending to distract the staff of the administration Bratskgesstroy from performance of its principal tasks--supervision of capital construction. All of this suggests the idea that in a certain stage of development subdivisions not functionally inherent in the principal purpose of the administration should be separated from Bratskgesstroy. But both organizational and economic problems have to be solved for this to be done. First of all, while still within the structure of the administration Bratskgesstroy these services should attain the necessary level of development and should have the subsidiary and auxiliary facilities they need for independent functioning thanks to their timely creation with the funds of clients and within the subdivisions to be made separate or through augmentation of capacities in specialized services. In the latter case there must be guarantees of the punctuality and completeness of delivery of products or services. Second, it is advisable to equalize conditions for remuneration. The reason is that in the administration the regional coefficient is higher than in the organizations of the infrastructural ministries and departments to which the subdivisions transferred from Bratskgesstroy would become subordinate. Third, it is necessary to settle the issue of compensation for the losses which such subdivisions incur because of imperfection in the system of prices and rate schedules for their products and services. For example, because transportation is a losing operation, development of bus transportation by common carriers is not developing on routes needed for commuting to and from work. As a consequence more and more workers are being carried by the departmental motor pool.

In Ust'-Ilimsk (in its right-bank portion) the functions of acting as principal client for housing and utility projects and of operating them are the responsibility of the management of the Ust'-Ilimsk Pulp Mill. But it is not possible to achieve full centralization because of the endeavor of the departments to "economize."

On the whole it has still not been possible to fully overcome fragmentation in the building and operation of infrastructural projects. Along with the very large enterprises there are small departmental institutions serving the needs of a single production operation. In Bratsk, for instance, in addition to the worker supply administration of Bratskgesstroy trade and food service are also engaged in by organizations subordinate to the worker supply administrations of the river fleet, transportation construction workers, the timber and lumber industry and the Ministry of Railways. They do not compare with it in the volume of sales. The administration Bratskgesstroy accounts for the manufacture of 94 percent of the reinforced concrete, but the production of the other 6 percent is scattered over 5 organizations with an annual output of a few thousand cubic meters. A major portion of the buses are operated by organizations not specialized in this activity. As a consequence of this kind of decentralization it is more expensive to produce local building materials, it is difficult to achieve the proper organization of public transportation, to provide trade services, and so on. The leading and coordinating role in deciding all these questions should be assigned to agencies of local soviets of people's deputies, which are responsible for this work under current legislation. But since the sectoral ministries and departments, which have the financial and physical resources, have heretofore been doing this work, the agencies of local soviets later end up in the role of observers or monitors. It would seem that before building a city or settlement its administration should be organized, and it should take on the functions of client. It would officially accept the project plan from the urban construction institute, would monitor adherence to norms and regulations in the design of industrial and residential zones, would prepare all documents for the contractor, and so on. Following creation of the soviet of people's deputies, it would become its capital construction division. This practice has fully justified itself in industry, in transportation, and so on. It will make it possible to relieve the industrial, transport and other organizations interested in building the city or settlement of tasks that do not fall within their principal specialization and will eliminate the scattering of funds.

In essence the project plan of the city or settlement is the principal preplanning document, and its existence will make it possible to solve the problems of planning their development on a sound basis. Even before activation of housing and utility projects services should be created within agencies of local soviets for operation of all their elements, and they should be furnished the necessary buildings, installations, machines, equipment, and so on.

Experience in building the Bratsk--Ust'-Ilimsk TPK has shown that a number of issues related to development of the construction capability, the building materials industry, transportation, and so on, need to be planned and optimalized at the level of the city or settlement: they can be resolved only for the TPK as a whole. This means that management of the functioning of the entire economy of the TPK needs to be improved. It is problematical to do this within the framework of the procedure for planning and management that is now adopted.

As we see it, the principal reason for this is that this area lacks an element of management such as a comprehensive plan for economic and social development of the economy of the TPK. Sectoral ministers record in the 5-year plans assignments for development of their enterprises and organizations without the requisite linkage to the overall goals and tasks of building the TPK. Quite often ministries alter the size of appropriations and dates for activation of projects as given in the 5-year plan in order to fulfill targets assigned to the entire ministry. This has not made it possible to keep a clear perspective either in the stage of infrastructural preparation or in the stage of intensive formation, nor to prepare in advance for new types of work. As a result efficiency of setting up the TPK has dropped.

In view of the need for proportional development of all elements of the TPK, the CPSU Central Committee and USSR Council of Ministers have in the decree entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" ordered USSR Gosplan to join the RSFSR Council of Ministers and interested ministries and departments to examine charts of development of the productive forces of TPK's for the regions of Siberia and the Far East, to assign indicators of their economic and social development, and to monitor their fulfillment.

Efforts on preplanning and project planning preparation for development of TPK's need to be stepped up if this is to be effectively achieved, and agencies responsible for each specific TPK need to be created at the local level and at the center.

CERTAIN PROBLEMS IN THE DRAFTING AND PERFORMANCE OF COMPREHENSIVE REGIONAL PROJECTS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 132-136

[Paper by Yu. G. Benderskiy, Krasnoyarsk Division of the Institute for Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences]

[Text] Experience in using the target-program approach in regional planning makes it possible to examine a number of new questions whose examination in regional studies would have raised the scientific level of plans.

One such question is to take scientific-technical progress into account. We will demonstrate this with the example of drafting and carrying out the project of the plan for comprehensive development of the productive forces of Krasnoyarskiy Kray in the 1971-1980 period. When the project was drafted, advances in scientific-technical progress were taken into account that ensured solution of the problems of intensification of production and speeding up the rise of labor productivity as well as a number of socioeconomic problems. Fuller utilization of energy, raw materials and water resources, increased production of agricultural products and also creation of conditions for attracting and holding personnel in Krasnoyarskiy Kray were adopted as premises. Moreover, advances in implementing the decisions of the September (1965) Plenum of the CPSU Central Committee on the transition to the new system of planning and management were taken into account: as a result of faster scientific-technical progress in the Eighth Five-Year Plan the rise of labor productivity in the kray's industrial sector was 46 percent as compared to the 38 percent in the previous 5-year period; favorable shifts took place in the sectoral and regional structure of production.

An analysis shows that the conception of the economic development of the productive forces of Krasnoyarskiy Kray was based on taking into account the potential of the natural resources, the regional peculiarities of production and technical-and-economic capabilities. This was manifested in the orientation of the preplanning scientific documents which preceded acceptance in 1971 of the solutions set forth in the plan, which called for attainment of high rates of development of natural resources and a rise in the standard of living of the region's population, as well as achievement of high efficiency of utilization of existing and newly built capacities.

But as the project was carried out it became evident that not enough work had been done in preplanning studies on certain aspects of scientific-technical progress and that industries were not prepared to utilize its advances, which was reflected in the quantitative and qualitative parameters of the region's economy. Without setting ourselves the goal of eliminating all the problems related to development and realization of comprehensive regional programs, we will attempt to examine certain of their aspects which in our opinion have a bearing on raising the scientific level of regional planning.

One of the central problems is the question of improving preplanning substantiation of the development of the productive forces. An analysis shows that three-fourths of the projects planned for construction in the 1971-1975 period and for which the project plans and documents had been prepared for 1971, i.e., before commencement of fulfillment of the plan, went under construction in accordance with the assignment or with a delay of 1-2 years. On the other hand approximately 70 percent of those projects on which no construction at all was done in 1971 had no project plans or estimates whatsoever.

It is obvious that the existence of project plans and estimates substantially improves the "reliability" of the project's inclusion in the construction plan, but an analysis of one of the versions for the development of the productive forces of Krasnoyarskiy Kray in the 1981-1990 period made it possible to discover a steady tendency of including in the construction plan projects for which the relevant project plans and estimates had not been furnished. For instance, of the 56 projects recommended for construction in the 1981-1985 period, project plans and estimates were not being prepared for 37, including 18 projects whose construction was supposed to begin in 1981. Since the preparation of project plans and estimates of a large enterprise takes approximately 2 years, the "programming" of anticipated results which are unrealistic is obvious.

Shortcomings of preplanning studies and solutions based on them have a particularly vivid effect in the final stage of carrying out the particular project.

It was assumed that the rise of labor productivity would be 46 percent in the Ninth Five-Year Plan and 48 percent in the 10th. In actuality it was 40.2 percent in the 1971-1975 period (87.4 percent of the calculated level) and approximately 20 percent in the 1976-1980 period (41.7 percent of the calculated level). Volume indicators of development of industrial production were fulfilled accordingly.

The specific reason for this is that regional planning, especially when multiannual plans are being justified, does not sufficiently reflect the interrelationship between scientific-technical development and economic development. It is important to note in this connection the need for improvement of the scientific preparation of intended projects for development of the productive forces, since its underestimation is inflicting substantial losses on the national economy. For example, because the impact of operation of the Krasnoyarskaya GES on changes in the water, hydrobiological and thermal regimes in the lower pool was not fully studied, sizable capital investments (about 30 million rubles) were required to rebuild the water intakes, ferry crossings and docks, to correct the flooding of settlements with groundwater, and so on.

The most important requirements for scientific-technical policy, which are dictated by the regional peculiarities of economic development, had been defined by the time the project was drafted for development of the productive forces of Krasnoyarskiy Kray in the 1971-1980 period. They included taking into account the peculiarities of the natural resources in developing new pieces of equipment, taking into account the natural and climatic conditions in creation of technology, ensuring scientific-technical progress that would also meet the requirements of natural conservation, developing specific labor-saving designs on the basis of a higher amount of power per worker, automation of production, and so on.

But an analysis of actual progress in carrying out the economic program indicates that these principles were not sufficiently taken into account in implementing technical policy in the kray. In the years of the 9th and 10th five-year plans advances of scientific-technical progress did not have an essential effect on the rise of growth rates and efficiency of social production. In the Ninth Five-Year Plan the rise of labor productivity accounted for 80 percent of the growth of industrial output, but its share in the 1976-1979 period was 72.9 percent. At present the level of power per worker and the ratio of capacity to capital in the kray's industrial sector do not exceed the indicators achieved in comparable production operations in the European part of the country.

Our calculations show that the composition of the metal manufacturing equipment in Krasnoyarskiy Kray lags considerably behind the equipment of the industrial sector in Ukrainian SSR, for example, with respect to the orientation toward progressive technological processes (there is a higher relative share of metal-cutting equipment and a correspondingly lower share of progressive groups of forging and pressing and casting equipment, a 1.5-fold higher share of manual welding equipment, which is imperfect from the technical-and-economic standpoint, in the composition of welding equipment, and so on).

The reason why the output-capital ratio dropped was that the value of new equipment increased faster than its productivity, design capacities were slow to be attained, and the structure of fixed capital deteriorated, all of which had an adverse effect on the rise of labor productivity. Whereas in the Eighth Five-Year Plan the drop in the output-capital ratio lowered labor productivity 14 percent according to our calculations (while the rise of the capital-worker ratio increased it by 60 percent), in the Ninth Five-Year Plan it reduced it by all of 16 percent.

The labor-saving benefit of introducing measures embodying new technology is lagging considerably behind the indicators achieved in the country in general. In the 1971-1978 period the number of workers made available thanks to adoption of measures embodying new technology in the industrial sector of Krasnoyarskiy Kray increased only 15 percent, whereas over the same period this indicator was 40 percent for the USSR. The number of adjusted workers made available per million rubles of outlays (including outlays from past years) was 55 in Krasnoyarskiy Kray in 1978, while it was 64 in the USSR.

Work began in 1978 on a comprehensive regional program for accelerated introduction of the advances of scientific-technical progress in the economy of Krasnoyarskiy Kray in the period 1981-1990. The drafting of the program was preceded by a study of the key regional problems of scientific-technical progress and of formation of the scientific-technical potential in their interrelationship with the framing of the conceptual bases for future development of the productive forces of Krasnoyarskiy Kray.

The comprehensive program was aimed at implementing a labor-saving technical policy, whose importance is evident from the mere fact that 40 percent of the workers in the kray are still engaged in manual labor. At the same time we should note the sizable potential for reduction of live labor by improving the drafting and fulfillment of that program. Constructive experience with the program approach to reduction of manual labor in construction in Belorussian SSR made it possible to double the reduction of labor required as compared to the preliminary version of the program drafted in Krasnoyarskiy Kray.

A study of various regional programs of scientific-technical progress shows that they lack a unified theoretical foundation, there is a rather wide divergence in the methods and standards used, and the regional aspects of scientific-technical progress are not reckoned with as they should be in posing the goals of the programs and in working out their indicators.

The projects for comprehensive development of the productive forces of Krasnoyarskiy Kray in order to increase the efficiency of the kray's most important economic sectors and industries provided for the development of existing scientific institutions and the organization of new ones. About half of the most important measures that were supposed to ensure effective fulfillment of the project have to do with drafting a variety of technical-and-economic reports and justifications for development and location of new enterprises and the most efficient methods of developing natural resources and improving the geographic organization of production. A high majority of these measures have been carried out.

At the same time formation of the regional scientific-technical potential was speeded up in the direction of building a logically interrelated chain—from theoretical and basic research to application of new engineering and technology to production, including the training of the relevant personnel with high qualifications.

The effort to carry out the project for comprehensive development of the productive forces of Krasnoyarskiy Kray also revealed certain problems in the formation of the regional scientific-technical potential, problems whose solution was very crucial to speeding up scientific-technical progress. We should note first of all shortcomings in development of the pilot production facilities of scientific research institutes and VUZ, which causes serious difficulties in the application of scientific advances to production. It is sufficient to note, for example, that nonfulfillment of the program for setting up full-scale experimental units for combustion of Kansk-Achinsk coal was one of the reasons for the sizable delay in the study and mastery of a promising technology for burning coal in the units of the KATEK.

It is equally important to bolster intersector and interdisciplinary research. "Vertical" formation of the chain of the scientific-technical potential has been considerably in advance of "horizontal" integration of scientific research. As a result many very important problems in development of the kray's productive forces, problems which are interdisciplinary in nature, have not been researched.

Fulfillment of plans for development of kray's productive forces has resulted in a restructuring of the regional planning system. The comprehensive, multiannual and program aspects of economic and social planning have been substantially reinforced. The staff of the kray planning commission was reorganized, and new indicators were adopted in statistical reporting. At the same time the outline of the regional plan essentially copied the plan drafted in the republic and did not reflect the uniqueness of the economic problems of the region. Indicators of scientific-technical progress are not reflected in the plan at all.

The present experience in drafting and in practical implementation of long-range projects for comprehensive development of the productive forces of Krasnoyarskiy Kray makes it possible to identify the following directions for improvement of the regional aspect of planning scientific-technical progress. First, standards and indicators for planning scientific-technical progress should be worked out on the basis of a study of regional problems of interchangeability of resources, identification of the regional peculiarities of the social efficiency of scientific-technical progress, and so on. Second, there needs to be improvement in the methodology for preplanning substantiation of the geographic organization of the productive forces on the basis of a consideration of the regional peculiarities of scientific-technical progress. Third, it would be worthwhile to work on the planning and management aspect of comprehensive regional programs (including subprograms of scientific-technical progress), including improvement of the mechanism for carrying out the program within the framework of a single planning technology (in interact[illegible] with the planning methods of balances, standards and mathematical economics).

ANALYSIS OF THE IMPACT OF A TPK ON DEVELOPMENT OF ADJACENT AREAS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 136-143

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[Text] Space-time differences in the orientation and intensity of the economic development of areas where TPK's are being formed and of the zone of its impact are manifested most vividly in the population dynamics, changes in the composition of the population, in the extent of habitation of the region, etc. Retrospective analysis, then, of various aspects of the geography of the population of areas similar in the conditions of their development and in the particular stages of development they have already passed through could serve as initial material that would help to solve similar problems in other regions of Siberia.

At a conference on the study of the productive forces of Irkutskaya Oblast (in August 1947) N. N. Kolosovskiy expressed a valuable proposition from the standpoint of methodology to the effect that "the achievements of science are not determined by the number of facts collected, but by their comparisons and interpretation." This approach is especially necessary "when one is studying such a huge, complicated and little-studied region as East Siberia.... The number of facts which attract the attention of researchers here is unlimited. Yet the time which we can make available ... is limited." He accordingly emphasized the importance of making a periodic comparison of the "facts established with one another and against the goal-oriented assignments set previously," as a means of "establishing assignments for the future in order to obtain the best results at the price of the smallest efforts and expenditures of time."* In accordance with this proposition, in drafting the "Large Project" for utilization of the resources of the Angara--Yenisey regions N. N. Kolosovskiy proposed that the

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* Kolosovskiy, N. N., "Problemy territorial'noy organizatsii proizvoditel'nykh sil Sibiri" [Problems of the Regional Organization of the Productive Forces of Siberia], Novosibirsk, 1971, p 24.

Urals--Kuznetsk Combine, which at that time had been in operation for 15 years, be taken as the "natural quantitative standard." Now the Middle Angara regions have been developing for 25 years and can themselves serve as a standard in determining the prospects for development of other TPK's in Siberia. The results of a study of the process of their settlement can accordingly have a certain relevance. Up until the fifties these areas had been little developed and were sparsely settled. Agriculture and primitive economic activities were the basis of their activity. The Tayshet--Lena Railroad essentially changed their economic-geographic situation. Favorable preconditions were created for the transition from extensive forms of development to more intensive ones: exploitation of hydropower potential and mineral and timber resources. As we know, the economic development of new areas brings about a substantial restructuring of the existing interregional relations. The shifts that take place are reflected by variations in the proportional distribution of the oblast's population among its rayons more clearly than anything else. This indicator reflects fairly accurately the rayon's place in the division of labor within the oblast.

An analysis of districts with a different concentration of population made it possible to ascertain the character of the changes resulting from creation of new economic centers within Irkutskaya Oblast. In 1926 (this distribution persisted in its basic outline even in 1939) the district in which 75 percent of the population lived was a continuous strip of rayons that had more or less similar importance and were strung along the main railroad. Irkutskiy Rayon (18 percent of the population)--the center of the district--was distinguished by a higher proportion. The reason for this is that substantial changes in the geography of the population of the oblast in the first years of Soviet power were related to a radical restructuring of agriculture, which mainly affected the southern farming areas, bringing about a growth of their population as well. In subsequent years development of the productive forces pursued the direction of industrialization, development of the timber and lumber industry in particular. Prerequisites accordingly took shape for a growth of population in Tayshetskiy and Nizhneudinskiy rayons.

The spatial differentiation of rayons with respect to the level of concentration of population that had been noted by that time underwent further development as the area located along the Tayshet--Lena line became involved in industrial development. The gap in the zone of population concentration that had been noted by 1959 became more distinct in the seventies with development of the Bratsk--Ilimsk TPK and the shift of the district of higher population growth eastward to the area where the new section of the BAM was being built. At the present time we can speak of the existence of two districts of settlement, each with its own center--Irkutskiy and Bratskiy rayons. In the rayons adjoining them the population growth index is lower, and the further a rayon is located from the center of the concentration of population, the larger the size of the drop. The largest drop in the share of population was noted in Zalarinskiy Rayon, and it can therefore be regarded as the boundary between the Irkutsk--Cheremkhovo and Middle Angara districts of population density.

Thus not only the rayons where new centers of industrial production were actually being formed, but also more remote areas which come within the zone of influence of these centers, which have boundaries typical of such zones, undergo a restructuring as a consequence of the creation of those centers. This forced us to turn particular attention to identification and study of districts of interrelated settlement in order to take into account the patterns of its formation in drafting projects for development of areas gravitating toward TPK's which are to be created. In this respect the Middle Angara district, which occupies half of the oblast's area and contains nearly half of its population, has the greatest relevance.

Differences between rayons where the nuclei of TPK's are actually being formed and adjoining areas are traced most distinctly in an analysis of changes in population. For instance, within the Middle Angara district of population density the analysis made it possible to discover three groups of rayons that differ in their pattern of population dynamics.

I. Ust'-Ilimskiy, Bratskiy, Nizhneilimskiy, Ust'-Kutskiy and Chunskiy rayons are those that underwent the most vigorous postwar development. Their development is distinctive in that detached from the main lines they were for a long time underdeveloped areas with a low population density. The population in them hardly increased at all, and in some it decreased. In the fifties the situation changed.

The advance of the Tayshet--Lena Railroad and the economic upsurge of these rayons brought about a sizable population growth in a comparatively short period. At present these are the only rayons in this district where the population has been increasing since 1959. The highest growth rates were in Ust'-Ilimskiy and Bratskiy rayons, where the population nearly tripled between 1959 and 1979. In subsequent years, to be sure, the growth rates have dropped somewhat. An exception has been Ust'-Kutskiy Rayon, which indicates a displacement of the centers of active development further eastward. As a consequence of the population growth the share of this group of rayons in the oblast's population has risen considerably.

II. The second group is made up of the rayons located on the Transsiberian Railroad. Thanks to its position and more favorable conditions, their vigorous development began earlier than in the rayons considered above. Up until 1973 the relative share of this group in the oblast's population was higher than that of the first. In 1973 they came even, and since 1974 they have alternated places, i.e., the functions of determining the development of this district of population density have passed over to the rayons in the first group.

III. The third group is made up of reserve rayons--those which are more remote and have weaker connections with the oblast's economic centers. In them we trace a steady tendency toward a drop in population, and consequently a drop in the level of population density. The situation of these rayons underwent an essential change when construction was begun on the BAM.

Population quadrupled in the Kazachinsko-Lenskiy Rayon, and population growth has been observed in Kirenskiy. The outflow of population persists at present in Kachugskiy and Zhigalovskiy rayons, located between the rail lines, but their inclusion within the planned Upper Lena TPK will have a beneficial effect on their development and will bring about a positive change in indicators of population dynamics.

Thus a retrospective analysis of population dynamics made it possible to ascertain that a sizable growth of population corresponds to the period of formation of nuclei of TPK's. Then the growth rates slow down, and sometimes they even drop. This latter circumstance has been observed in rayons where construction of the basic projects of the TPK is followed by their smooth operation and inertia is manifested to a greater degree in the formation of the population.

Simultaneously with the expansion of the inhabited districts, there is a "depthwise" restructuring of settlement, as indicated by the rise in population density and displacement of districts with high density into the rayons where new economic development is taking place. The intensive process of their settlement (merging of separate foci) results from the rapid rates of industrial development.

The fundamental restructuring of the economy has brought essential changes in the geographic distribution of settlement. We should mention among the initial criteria reflecting this distribution the development of urban forms of settlement, which are most intimately bound up with industrial development. In the district as a whole the urban population increased nearly 25-fold between 1926 and 1979, while the overall population growth was 2.5-fold.

In 1926 there were in this area only four cities (Tulun, Zima, Nizhneudinsk in the southern part of the district and Kirensk in the northeast), and 7 percent of the population lived in them. In 1950, i.e., on the eve of construction of the Tayshet--Lena Railroad, there were already nine urban settlements in the southern part of the district, and they had a population totaling more than 100,000, and by that time in the northern part three transportation junctions had emerged on the Lena and Angara rivers. They had a population slightly exceeding 10,000. At the present time 24 of the 42 urban settlements in this district are in regions of new economic development. Thus the wave of vigorous townbuilding, which in the 1939-1959 period was typical of the previously developed regions, had moved northward. In this connection we should note that in spite of the numerical equality of urban settlements of the rayons previously developed and the rayons where postwar development was most vigorous, the population of the latter exceeds by 1.7-fold the population of the urban inhabitants of the former rayons. Urban forms have taken the lead in settlement, accounting for 60 percent of the population.

It is relevant to note that the city of Bratsk accounts for half of the urban population. If we omit it from the calculations, then we get almost equal population distribution of the urban settlements in the southern and northern part of this settlement district. In our opinion this similarity results from the specific nature of their evolution. The leading town-building factor for most of them has been the timber and lumber industry. This unifunctional production orientation has served as a restraining and unifying factor in their development. Traditionalism in the design of these settlements has also contributed to this in some degree. The materials of censuses and annual current vital statistics reflect a substantial growth only of those cities which have a broader production configuration--Bratsk, Ust'-Ilimsk, Ust'-Kut, which account for more than 60 percent of the growth. In the other urban settlements growth has either been slight or has not occurred, and in some (Vidim, Novaya Igirma, and Shestakovo) a drop in population has been observed.

In analyzing this phenomenon we must not overlook certain peculiarities in the formation of urban settlements under the specific conditions of Siberia. That is, at first several functionally related but spatially separate settlements associated with the principal settlement are often included in urban settlements. As this "composite" urban settlement develops and the level of development of the surrounding area rises, there is a separation of the individual parts and a formation of independent urban, but more frequently rural settlements. In a number of cases it is this which has a dampening effect on the objective character of development of the main (nucleus) urban settlement.

Small settlements of the urban type now constitute the basis of urban settlement. In this connection we should note that isolated urban settlements mainly performing administrative functions are typical of predominantly agricultural rayons, whereas in rayons which are industrially developed local clusters of settlement, concentrated around the larger industrial centers, are formed. The growth of such a cluster occurs either thanks to the growth of the center or because of inclusion within it of tiny narrowly specialized settlements built in districts of new industrial development and promoting "breadthwise" development of urban settlements. This is above all a manifestation of the narrowly specialized orientation of the development of regions being developed for the first time. As the growth of this unifunctionally settlement "accelerates," the sources of its population change; to be specific, natural growth becomes the principal factor, and it does not always exceed the outward migration. As a result growth rates drop, and we sometimes observe a loss of population, so that the settlement loses its urban functions. A closer linkage of their functions with the economic orientation of the rayon, accompanied by enhancement of their role as centers for serving the rural population, could have a large impact on development and improvement of urban forms of settlement (especially of small urban settlements).

Year-by-year analysis of the population dynamics has made it possible to note a certain sequence in development of urban forms of settlement. Construction of industrial centers, especially in the initial stages of formation of a TPK, when the enterprises on which it is based are being built, is accompanied by a substantial population growth that brings about an essential differentiation of urban settlements with respect to rates of development. Thanks to the accelerated growth, in relatively short periods of time they achieve the parameters of the composition of urban settlement typical of the district as a whole, and then the rates of growth drop, which in the formation of urban settlements tends to smooth out the sharp differences between rayons and to equalize them to a certain extent. Thus similarity in the population structure of urban settlements of newly developed and previously developed rayons can be taken as a sign of a certain stabilization in their development, which better corresponds to the stage of exploitation of resources at a uniform pace.

The materials of the study showed that a rise of a relative indicator such as the proportion of urban population does not always reflect actual development of an urban settlement. The reason is that this indicator rises when there is a drop in the rural population (Tayshetskiy, Chunskiy and Kirenskiy rayons), when the rural population decreases faster than the urban population (Nizhneudinskiy, Zhigalovskiy and Kachugskiy rayons), and when the growth of urban settlements is faster than that of rural settlements (Bratskiy, Ust'-Ilimskiy and Kazachinsko-Lenskiy rayons). On the other hand if the rural population grows faster than the urban population, there is a drop in the latter's share even though it experiences absolute growth, as took place in Nizhneilimskiy and Ust'-Kutskiy rayons.

Thus in analyzing the pattern of changes in settlement, especially in determining the role of urban populations in settlement, we need to take into account the peculiarities of dynamics of the rural population. Over the entire period from 1926 to 1979 it dropped 13 percent in the area we are studying.

In the early fifties the rural population had grown in almost all rayons, but between 1959 and 1970 it increased in only two: Ust'-Ilimskiy and Ust'-Kutskiy. The drop in the size of this population in such rayons as Bratskiy, Nizhneilimskiy and Chunskiy was related in that period to transformation of rural settlements into urban settlements; but in Nizhneudinskiy and Tayshetskiy rayons it had to do with an outflow of population from rural localities. Between 1970 and 1979 Bratskiy, Kazachinsko-Lenskiy and Nizhneilimskiy rayons were added to the rayons with a growth of the rural population (Ust'-Ilimskiy and Ust'-Kutskiy). It is interesting to note in this connection that later the rural population increased because settlements of the urban type diminished in size as a consequence of separation of certain settlements to become independent rural settlements. In other rayons--south of the previously developed rayons and those between the railroads--there has been a steady drop of the rural population.

Thus on the basis of the nature of the dynamic relationship between the urban and rural population one can identify three categories of rayons: 1) Those with a growth of the urban and rural populations, which is inherent in regions of new industrial development, where along with urban developments rural ones also undergo intensive development, mainly nonfarming rayons involved with exploitation of natural resources. 2) Rayons with a growth of the urban population and a decrease of the rural population. In some of them the growth of the urban population offsets the loss of rural inhabitants, thereby ensuring an overall growth of population. In others where the urban populations are not major industrial points, the growth rates are not sufficient to offset the loss of rural population, and in these rayons we observe a decrease in total population. The latter pattern is most typical of rayons of old agricultural development. 3) The group of rayons "between the railroads," where we observe an outflow from both urban and rural settlements.

One of the most general characteristics of regional shifts in distribution of the rural population is the coefficient of regional concentration. Its changes over the period from 1926 to 1979 reflect a definite leveling out in the distribution of the population, which occurs because of directly opposed processes of settlement in rayons where active development has previously occurred and where this period is continuing or is only beginning. In the former rayons the concentration of population decreases correspondingly, while in the latter it increases.

Radical regional changes in rural settlements have been caused by the creation of reservoirs and by transportation and industrial construction. They were manifested above all in the springing up of new districts of population density. For example, by 1959 a ramified network of settlements had been created almost from scratch along the Tayshet--Lena Railroad and south of it within what is now Chunskiy Rayon. In 1926 there were only 2,000 persons living in this area, but in 1959 the rural population alone numbered more than 20,000. Formation of a separate district of settlement here with its urban centers led to a revision of rayon boundaries in this part of the oblast and creation of the independent Chunskiy Rayon. In Bratskiy Rayon a network of settlements sprang up in the area between the Oka and Angara rivers--places which previously had not been inhabited. After the forest had been cleared from the bed of the Bratsk reservoir, some of the timbering organizations were transferred to the north, creating there new nuclei of settlement. The need also arose there to form an independent administrative entity (Ust'-Ilimskiy Rayon). The pattern of settlement changed in the eastern part of the area being studied, which was oriented toward agriculture and primitive crafts: settlements on the upper Ilim vanished entirely, and they became rarer and smaller on the upper Lena. A similar pattern was observed in the valley of the Kirenga River. At the same time large new settlements, which quickly grew to become settlements of the urban type, have recently emerged along the Baykal-Amur Main Rail Line which is under construction. We should note on the whole that in the process of regional shifts there is a change in the composition of the rural population itself and this is particularly substantial in areas of major new construction projects. The southern farming portion is distinguished by relative stability, and changes in its settlement are related mainly to internal restructuring of the network of farming settlements that had previously taken shape.

In accordance with the change in the economic configuration of rayons and geographic redistribution of rural population, there has been a restructuring of rural settlements. Since the 1970 Population Census the number of rural settlements has decreased 20 percent (23 percent in the farming rayons and 17 percent in the rayons of the future Upper Lena TPK and 14 percent in the rayons of the Bratsk--Ilimsk TPK). The drop has affected all categories of settlements rather uniformly. If we take the formal approach to this process, i.e., if we look at the quantitative relationship between the settlements, it turns out that no sizable changes occurred in the distribution of the settlements with respect to population size. But a more detailed study of the population dynamics of the settlement in which a matrix of the transition of rural settlements from one population group to another was used showed that there is a vigorous ongoing process of redistribution of settlements with respect to population categories. As a result the number of settlements in a given group may not change, though the makeup of settlements within it will be different. The course of this process can be traced from the table.

	Share of Total Number of Settlements, %			
			Moving to Another Population Group	
Population of Settlement, number of persons	Eliminated	Remaining in Same Population Group	Downward	Upward
Under 50	70	28	--	2
51- 200	21	54	23	2
201- 500	7	62	27	4
501-1,000	2	68	23	7
Over 1,000	2	82	16	--

Though 70 percent of the small settlements (under 50) were eliminated, their number decreased negligibly: this group has all the while been replenished because of a loss of population by larger settlements. Only slightly more than half of the settlements have retained their position in the same population category. Moreover, 65 percent of them lost population, that is, they potentially constitute a reserve for small settlements. Thus the principal direction in development of rural settlements has been a growing outflow of population from rural settlements. For instance, whereas in the 1959-1970 period the ratio of growing rural settlements to those dying out was 1:2, by 1977 it was 1:4.

In the southern farming rayons, the basis for whose settlement are the agricultural settlements formed before 1926, we distinctly trace a reduction in the number and reduction of the size of rural settlements with respect to all gradations in population size. We need to note in this connection that population dropped faster than the number of settlements (especially in the group of settlements with a population over 200), which indicates a decrease in their size and consequently a drop in the level of the area's population density.

In the rayons of the Bratsk--Ilimsk TPK the pattern is somewhat different. Over the entire 1970-1978 period the network of settlements decreased, but the size of the rural population grew, i.e., a process occurred whereby the population became more concentrated. In actuality there was a substantial reduction in the number of settlements and population in settlements under 500 persons, i.e., in settlements with an agricultural configuration. Population of settlements exceeding 500 persons on the other hand (usually timber and lumber settlements) increased, as did their number. But a comparative analysis of two periods (1970-1975 and 1975-1978) showed that the growth rates were slightly lower in the second period. This makes it possible to suppose commencement of a certain stabilization in development of settlement, which could then be replaced by negative tendencies in development of the network of timbering settlements which are now being observed in neighboring rayons.

In the rayons of formation of the Upper Lena TPK the construction of the BAM has led to creation of a network of rather large settlements involved in providing its supporting services. Further development of settlements of this character will depend to a considerable degree on the strengthening and expansion of their functions and on holding on to the construction workers. The network that existed here previously was represented by rather small (mainly under 200) farming settlements and settlements with primitive crafts. Their number has been decreasing, as has their population.

The tendencies in development of rural settlement discovered in studying the structure of settlements compel us to be especially cautious about the unequivocal assumption that settlements exceeding a population of 500 should be regarded as promising ones. In the district we studied they represent only 20 percent, and no sizable increase of this category of settlements was observed in the period under consideration.

So, in compiling plans for development of TPK's we should not restrict ourselves to a narrow framework--to rayons in which its center (nucleus) is actually being formed; we also need to include in the analysis the entire zone affected by the complex. As shown by the examples of these rayons in Irkutskaya Oblast, and also by the experience of the Yakutskaya ASSR, creation of new economic centers not uncommonly tends to break down administrative boundaries formed previously. Consequently, the possibility of restructuring administrative division should be laid down in the program of the study, and in this case the calculations should go beyond the limits of existing administrative boundaries.

The mobility of settlements is manifested most vividly of all when there is a change in their functions--in connection with passage from the period of building the economic center to the stage of its uniform activity. This circumstance should especially be taken into account in determining the bases for existence of settlements and the prospects of their development. This principle applies not only to urban, but also to rural settlements, especially to those switching from farming functions to timbering and lumbering functions. As a rule after the timber resources are exploited, they do not return to their old occupation. Linkage of the settlement's functions with rural needs could have a large impact on their stability. In determining the degree of promise of a particular settlement we need to take into account the peculiarities of development of the entire network of settlements.

Taking these peculiarities of settlement of new areas and of those adjoining them into account could help to create a scheme for more optimum utilization of the entire set of conditions and resources of areas to be developed.

EXPERIENCE IN REGIONAL ANALYSIS OF THE ANGARA--YENISEY REGION

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 143-147

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[Text] Promstroyproyekt, an institute of USSR Gosstroy, has been exploring ways of increasing the effectiveness of location of new industrial enterprises. Present practice of locating industry is based on technical-and-economic comparison of different geographic points and on selection of the optimum variant. This practice took shape historically and by and large meets the tasks given it, but it has a number of serious shortcomings.

First, selection of the points for the technical-and-economic comparison is to a certain degree random, so that the most optimum variant could possibly be overlooked. Second, the accuracy of selection of the optimum site depends on the number of points being compared, and it is limited. Use of this method to locate industry has been made even more complicated by the lack of master charts of development of individual sectors and regions.

On the basis of a generalization of the experience of Promstroyproyekt in locating such major industrial complexes and enterprises as the Volga Motor Vehicle Plant [VAZ], the Kama Motor Venicle Plant [KamAZ], etc., the idea arose of switching from the method of comparing individual geographic points to the method of regional analysis, which guarantees examination of the possibilities of a given region for location of industry. In 1979 and 1980 the institute conducted a project entitled "Regional Analysis of the Angara--Yenisey Region" [AYeR], whose aim was to substantiate a variant for efficient location of industrial enterprises.

The essence of the method of regional analysis lies in studying the particular region in its entirety from the standpoint of the opportunities it affords for construction of industry on the basis of gradual reduction of the zone being explored as the area with adverse characteristics is whittled off. These adverse areas would include areas where natural inhibiting factors are widespread (karst, subsidence, torrents, earthquakes, and so on) as well as areas which do not have the necessary conditions for location of industrial enterprises, which is likewise regarded as a constraint (lack of land, water or labor resources, construction capabilities, and so on). Thus both natural and socioeconomic factors are analyzed. The natural factors can be restrictive and even categorical. The socioeconomic factors can only be restrictive.

The set of factors was determined for the Angara--Yenisey region on the basis of a summarization of experience acquired in the location of industrial enterprises. Charts of the sphere and degree of effect (chart of limitations) were filled out for each factor. The charts were done in one scale on a uniform basis by the collation map method. On the charts the different shades of hatching showed how categorical was the restriction resulting from the given factor's influence. The degree of detail and corresponding accuracy of the charts depends on the scale of the area being studied.

Charts were worked out for the following restrictions: a) natural phenomena prohibiting location of industrial enterprises (boggy areas, areas subject to mudslides and avalanches, karst phenomena, subsiding soils, etc.); b) medical-geographic conditions for the life of the population and the resistance of the natural environment to technogenic loads (potential loads on the soil, water and air base); c) the extent of the most important natural resources (minerals, farmland, water and timber resources--First-Category Forest); d) social factors: peculiarities of the existing system of settlement, the standard of living of the population, existence of an available labor supply and conditions for formation of labor resources from the various economic regions of the country; e) the increased cost of construction and installation work as a function of natural conditions (the length of the winter, seismic characteristics, permafrost, etc.); f) the economic loss from taking away the most important types of natural resources (farmland and forestland) for industrial construction; g) the present level and prospects for development of the infrastructure (rail and highway transport, the system of water supply and sewer system, the supply of electric power and heat, the level of development of construction capabilities and the construction industry).

Maps showing the extent of the natural phenomena being analyzed were used in compiling the charts of restrictions, along with topic studies of specialized institutes, Construction Standards and Regulations, and materials of planning and project planning organizations.

Below we give examples of particular restrictions associated with natural and economic factors and the procedural principles of working them up.

1. Regional changes in the size of capital investments in the AYeR are represented on a summary chart that reflects the change of capital investments because of the increased cost of construction and installation work as a function of the length of the winter season, seismic activity,

construction in the permafrost, prices and rates of consumption of materials and wage coefficients.

The quantitative relationship of the principal elements in the makeup of capital investments--the cost of construction and installation work (SMR) and the cost of equipment--is taken at 45:55, respectively, which is characteristic of the industry "machinebuilding," which is closest to the proportions for the industrial sector as a whole. The cost structure of construction and installation work consists in turn of the following elements: a) the base wage of workers, representing 12 percent of the cost of SMR; b) the cost of materials, intermediate products, components and fabrications, representing 60 percent of the cost of SMR; c) the cost of operating construction machines and machinery; d) overhead; e) planned accumulation.

Overhead and planned accumulation are not differentiated by region. The elements of direct cost, which total 78 percent of the cost of SMR, are adjusted by the corrective coefficients $K_{зп}$, $K_{мат}$, $K_{эм}$, which take into account the increased cost of each element by comparison with the base region (Moskovskaya Oblast) in the Angara--Yenisey region.

Below we give the formula for determining the magnitude of specific capital investments, which takes into account the influence of the factors enumerated above for the areas of the Angara--Yenisey region:

$$Y_{K_i} = \frac{\dfrac{0{,}45Y_{K_1}(0{,}12K_{зп} + 0{,}60K_{мат} + 0{,}06K_{эм})\cdot K_{зим}\cdot K_{вм}\cdot K_c}{0{,}78} + 0{,}55Y_{K_1}\cdot K_{об}}{Y_{K_1}},$$

where Y_{K_i}--magnitude of specific capital investments for the i-th area of the Angara--Yenisey region; Y_{K_1}--standard of specific capital investments calculated for the base region on the basis of conditions of construction (Moskovskaya Oblast); K--corrective coefficients which take into account the change in the cost of SMR: resulting from regional wage coefficients in the i-th area of the AYeR ($K_{зп}$), from regional prices and rates of consumption of materials in the i-th area of the AYeR ($K_{мат}$), and from the change in the cost of operating construction machines and equipment ($K_{эм}$) as a function of the length of the winter season ($K_{зим}$), for construction in the permafrost ($K_{вм}$), as a function of the seismic activity of the area (K_c); and $K_{об}$ is a corrective coefficient that takes into account the change in the cost of equipment by zones.

2. Restrictions related to the value of forest.

In this case the forest is viewed from two angles: as a natural factor that imposes restrictions of a categorical nature (Class I forest) on the location of industrial enterprises, and as an economic factor. The state incurs a material loss when it takes over forest area for industrial construction. In order to obtain an idea of the size of this loss when a particular area within the Angara--Yenisey region is taken over, an attempt was made to arrive at an economic valuation of forest in this region. The evaluation was made on the basis of a method developed in the All-Union Scientific Research Institute of Logging Machines (VNIILM) by I. V. Turkevich, candidate of agricultural sciences.

The criterion in economic valuation of timber resources is the total size of the benefit to the national economy obtained from their use. The indicator reflecting the size of the benefit to the national economy is the differential rent, which is defined as the difference between the socially necessary expenditures to obtain one unit of the product in exploiting the worst of the timber resources being used and the actual (individual) costs of obtaining that unit:

$$r = Z - \Pi_0,$$

in which r--differential rent, Z--marginal costs per cubic meter of wood, Π_0--individual imputed costs per cubic meter of wood.

The marginal costs are established on a centralized basis for the country's oblasts and republics. The imputed costs for production of 1 cubic meter of wood are the sum of the imputed costs of logging ($\Pi_{\text{з}}$) and the costs of cultivation ($\Pi_{\text{в}}$):

$$\Pi_0 = \Pi_{\text{з}} + \Pi_{\text{в}}.$$

The imputed costs of logging ($\Pi_{\text{з}}$) consist of the planned production costs ($C_{\text{з}}$) and specific capital investments in logging:

$$\Pi_{\text{з}} = C_{\text{з}} + E_{\text{н}} \cdot K,$$

in which K--standard of fixed productive capital for industrial purposes, $E_{\text{н}}$--standard coefficient of efficiency of utilization of fixed productive capital (0.15).

The imputed costs of cultivation of 1 cubic meter of wood ($\Pi_{\text{в}}$) are determined from the formula

$$\Pi_{\text{в}} = \frac{C_{\text{в}} + E_{\text{н}} \cdot F_{\text{л}}}{\Delta m},$$

in which $C_{\text{в}}$--operating costs in forest management, $F_{\text{л}}$--fixed productive capital for logging purposes, Δm--total average growth.

In this method the forest is regarded as a multifunctional factor. The entities being evaluated are the raw material function of the forest, the soil as a potential forest producer, and the natural conservation and recreation functions. Depending on the nature and size of the area for which the forest is being evaluated, the entities in the evaluation are those functions which are performed in the given area. For example, in this stage it is advisable to speak of evaluating the recreational functions of the Evenk Forest Management Operation. At the same time when dealing with green zones within cities, the recreational and natural conservation functions are a part of the evaluation.

In accordance with the main procedural principle of regional analysis, charts of restrictions reflecting phenomena of the same kind are imposed one on the other. On the summary chart of restrictions for natural factors are identified those areas which are unfavorable for construction, which will make it possible to reduce the zone being explored for location of industrial enterprises. The summary chart of restrictions related to a change in the cost of construction and installation work as a function of climatic conditions supplies information on the increased cost of construction and installation work as compared to their cost in the first construction zone (Moskovskaya Oblast), where it is taken as 100 percent.

The first stage of the regional analysis ends with the compilation of the summary charts for groups of phenomena of the same kind. The second stage begins after the assignment is received for location of a specific enterprise, which imposes certain requirements as to the area.

Information on the real capabilities of the territory (existence of construction capabilities and conditions for development of other infrastructural facilities, the size of the economic loss when farmland and forest area are taken over, and so on) are furnished by the relevant charts of restrictions. This work charts the road toward creating a data bank for construction.

EXPERIENCE IN USING MATHEMATICAL-ECONOMIC MODELS IN DETERMINING THE ECONOMIC STRUCTURE OF A REGION

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR--SERIYA OBSHCHESTVENNYKH NAUK in Russian (Issue No 2) No 6, May 80 pp 147-152

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[Text] In the field of application determination of the prospects for the economic development of a region embraces many aspects among which a particular place is taken by framing the goals of the region's development and the makeup of measures to achieve them, their correlation in proportions and in time, and solution of the problems of furnishing resources (at the national economic and regional levels). But performance of this process is more difficult because the possibility exists of selecting different sets of measures that define alternative strategies for the economic development of the region as a whole and its individual parts. An analysis of all the complicated situations and the framing of conceptions concerning the main directions and peculiarities of a region's economic development necessitate the elaboration of specialized methods.

One such method is the use of mathematical-economic models to determine the basic parameters of a region's economic development.* All the issues which are to be resolved here are distributed among three levels: the level of framing the goals of the region's future development, the level of the actual determination of the principal parameters and most significant features of the economic development of the region as a whole, and the level of working out alternative versions of development and methods of achieving the goals which have been set for the region.

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* Zverev, V. S., and Cherevikina, M. Yu., "Optimalization of the Production Structure of an Economic Region," in the book: "Metody analiza i modeli structury territorial'no-proizvodstvennykh kompleksov" [Methods of Analysis and Models of the Structure of Regional Industrial Complexes], Novosibirsk, Nauka, 1979, pp 197-212; Zverev, V. S., and Cherevikina, M. Yu., "Models of the Structure of an Economy of a Major Economic Region," in the book: "Voprosy sovershenstvovaniya narodnokhozyaystvennogo i regional'nogo planirovaniya v svete resheniy XXV s"yezda KPSS. Tezisy dokladov" [Problems in Improving National Economic and Regional Planning in the Light of the Decisions of the 25th CPSU Congress. Summaries of Papers], Part II, Moscow, Central Mathematical-Economics Institute of the USSR Academy of Sciences, 1977.

Differences in the problems, of course, determine differences in the models used to solve them. Spatial models of the national economy, in particular the interregional intersector optimization model, are most suitable to defining a region's development goal. The peculiarities and alternative versions of development of principal multisector and regional complexes* are described in sufficient detail by models well known as optimization models of multiannual planning of multisector complexes. The principal burden of interlinkage of the goals of regional development with its possibilities falls on models of the structure of an economic region's economy.

The method we have mentioned also presupposes a certain sequence in the use of models. In the first stage the calculations are made for the intersector optimization model, in the second for models of sectoral and multisector complexes, and in the third optimization models of the structure of the economy of the economic region.

The practical use of this method and its capabilities can be illustrated by the example of calculations for the materials of the Angara--Yenisey region. The first stage of the procedure--identifying the goals of the region's future development--was performed by defining the region's specialization in the nationwide division of labor and the social tasks to be performed in this regard at the level of the national economy as a whole in the period up to 1990. The series of calculations for the interregional intersector optimization model made it possible to identify the general direction of the region's development--an orientation toward further development of the fuel and energy complex, reinforcement of the region's role in furnishing the national economy energy-intensive products (metallurgy and chemistry) and forest products. Growth rates for the principal components of the standard of living (housing, services of the social-residential infrastructure, and so on) were determined simultaneously.

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* By a region's multisector complex we mean the totality of technologically related facilities of a number of sectors and industries manufacturing one of the types (or several types) of products which determine the region's specialization in the interregional division of labor. By a regional complex we mean the totality of facilities of one or several sectors of industries whose products or services are mainly (or entirely) used within the region. An example of a multisector complex (for the regions of Siberia) might be a complex of sectors and industries for logging and processing timber. The most typical examples of regional complexes are the construction complex and the entire group of sectors and industries in the service sphere.

Realization of the goals that have been set presupposes framing variants of development of a number of intersector and regional complexes. A number of general requirements are observed here: these alternative versions must be backed up with resources of sectoral significance (mineral, fuel and power, vegetative, land) in the region, the alternative versions must be realizable from the standpoint of the time required to build the projects that make it up (on the basis of known technologies and methods of organizing construction and installation work), the possibility of correlating the individual complexes with one another with respect to the time for activation of capacities and formation of spatial structures of the economy from them (regional industrial complexes). Moreover, in analyzing the development of intersector complexes it is important to discover alternative methods of achieving the goals which have been set. This can be done using various approaches to accomplishing the goal which has been set (selection of different product mixes within the consolidated group of products, a different level of processing of the initial raw material, and so on) within the limits of the region.

All these considerations determine selection of the set of multisector complexes under consideration and the alternative versions of their development. To be specific, the goals confronting the Angara--Yenisey region required that analysis of the prospects for development cover the totality of industries in the fuel and energy complex (coal mining, electric power production at thermal and hydrostations), complexes of industries for production of nonferrous (aluminum, lead, zinc and copper) and ferrous metals, a number of chemical complexes (petrochemical, complexes for processing organic chlorine and phosphorus-containing raw materials), and the complex of industries for logging and for processing timber. The social goals confronting the region determined examination of the system to provide for the life of the region's population (creation of the social-residential infrastructure, a number of subindustries of the food industry, and so on).

Variants of the development of multisector complexes differ in the makeup of technological processes ("conversions") within them and accordingly in the list of products, the scale of output, the use of particular advances of technical progress in various "conversions," the time of commencement of realization and dates for activation of capacities, and in the different parts of the region's area they pertain to. For example, for the complex of "timber" industries the examination covered different versions for logging (product--logs and industrial wood chips), logging and mechanical processing of the timber (lumber is added to the products in the previous version), logging, sawing and chemical-mechanical processing of the raw material (the additional products in this version are plywood and panels), and so on, all the way to variants in which paper, cardboard or artificial fiber are examined as the final products. The alternative versions are made internally consistent, i.e., the scale of production is chosen so that the previous "conversion" will furnish the necessary raw material (or semifinished products) to the next conversion, and they are linked to the calculated timber cutting for regional industrial complexes which have been identified in the Angara--Yenisey region (Lower Angara, Bratsk--Ust'-Ilimsk, Central Krasnoyarsk, Irkutsk--Cheremkhovo and Sayan TPK's). There are among the variants those which call for a differing degree of utilization of the calculated timber cutting by 5-year periods (this is the time interval selected as the "unit" in defining the prospects for development of the region's economy), beginning with the present level. Different sets of machinery in logging and different technologies for processing the raw material (especially for obtaining pulp/cellulose) are determined by differences between the variants in use of advances of scientific-technical progress. For some of the versions "trajectories" for construction of projects in the 1981-1985 period were examined, and for some trajectories in the 1986-1990 period. Phased versions were also examined: the first phase of creating the complex pertains to the 11th and the second to the 12th five-year plans, and also differing proportions in capacity in the first and second phases are selected in the alternative versions.

Performing operations of this kind for all multisector complexes constitutes a problem of the greatest complexity; they are very laborious procedures and necessitate involvement of specialists for each of the complexes being examined. But the greatest difficulties in this stage of the elaboration confront the specialists defining the prospects for development of the principal regional complexes. First of all, there are the problems of the scale of production (or the volume of services to be rendered). As a matter of fact when there are broad limits for development of multisector complexes and a sizable number of alternatives not only within the individual complex itself, but also in combinations of them with respect to makeup, time and the different parts of the region they pertain to, it is difficult to determine more or less unambiguously in advance the needs of the future economy for capacities of construction yards, transportation and services of a number of other types of production infrastructure and for labor resources.

Second, it is necessary to understand the peculiarities of the processes whereby an economy takes shape at the regional level and the specific nature of the conditions imposed on formation of the alternative versions of development of regional complexes. For example, such local goals as creating a strong construction capability that would exist permanently in the region as the basis for future stable development of the economy, or providing conditions for attracting and holding population, cannot but be manifested in the framing of the variants of development of the construction capability and the sectors and industries making up the social-residential infrastructure. In addition, the existing economy of the region also has a certain influence.

For the reasons given variants of development of regional complexes with a rather broad range of "capacities" and with differing trajectories of their change in time and technologies were framed for each of the TPK's of the Angara--Yenisey region.

All these data on possible variants of development of multisector and regional complexes and on the peculiarities of their interaction (use of products, services and resources) and participation in achieving the goals which have been set the region are used in calculations for the multiperiod model of optimization of the production structure of the economic region. The objective of the calculations is to obtain the basis for working out a balanced variant of the region's economic development and to shed light on its most essential peculiarities.

A whole series of such peculiarities emerged when the method was applied to the Angara--Yenisey region. First of all there was the division of the 1976-1990 period with respect to the character of economic development: the 10th and beginning of the 11th five-year plans represented work toward the future--in this period the principal capacities of new construction capabilities were created so that the total capacity of the region's construction yards was approximately doubled. The 11th and 12th 5-year periods are periods of intensive construction and activation of projects of intersector complexes and of solving the problems of raising the standard of living of the population. In particular, the calculated volume of products shipped out of the region in the 1981-1985 period exceeded by 2.7-fold the corresponding indicators of the 10th Five-Year Plan, and in turn the relationship of these indicators between the 11th and 12th 5-year periods was 2.3:1. In that same period provision was made to first reach the average republic level in the adequacy of housing, facilities of the social-residential infrastructure, and so on, and then to exceed that level.

The role of the characteristics of the investment process (level of outlays in the building and operation of construction capabilities and construction time) in the region's economic development proved to be important. The rather long project construction times delayed dates for fulfillment of plans for development of the most important intersector complexes. It was accordingly necessary to "employ" labor resources made available because of the rise of labor productivity and the passing of the "peaks" in the scale of construction and installation work. These "reserves" represent between 7 and 28 percent of the total work force at the various TPK's in the 12th Five-Year Plan. Assuming that the present technology of new construction is retained (and standard construction times), this makes it mandatory to develop the industries of the existing economy at rather high rates (through reconstruction and increasing the volume of production), which does not in every case conform to the general direction of future economic development and diminishes possibilities of achieving the goals set for the region.

The level of labor intensiveness and materials intensiveness in construction turned out to be too "burdensome" for the region when existing technologies were used. When consideration was given to expenditures in industries related to construction and the needs for construction and installation work in building the construction capability itself, related production operations, and the social-residential infrastructure, ways could not be found of reconciliation of the requirements of simultaneous construction of new construction capabilities and solution of the problems of raising the standard of living of the population, since the full costs involved in construction, which were of considerable size, were not covered by the volume of construction and installation work they were to perform. This discrepancy was particularly large for regional industrial complexes in the first stages of formation (the Lower Angara TPK). Performance of programs for social development in the Angara--Yenisey region were made directly dependent on the level of development and technical adequacy of the construction capability and methods of organizing construction. Effective solution of social problems becomes possible thanks to radical improvement of technical-and-economic indicators of construction (reduction to approximately half the indicators of labor intensiveness and materials intensiveness in the production of building materials and fabrications and in construction and installation work) and to application of a strategy for economic development of new TPK's to be created thanks to construction capabilities of areas already developed (in particular construction capabilities of the Central Krasnoyarsk and Bratsk--Ust'-Ilimsk TPK's), i.e., pursuing the strategy of "rear" construction capabilities for speeding up the economic development of regions undergoing new development. Otherwise it would be necessary to conduct a specific policy for the first stage of building the construction capability--use of the tour-of-duty method with its known lower level of comfort, smaller number and volume of services provided to construction workers as compared to inhabited areas.

It is typical of the Angara--Yenisey region that the fuel and energy complex exerts a substantial impact on the scale of development and structure of the most important multisector complexes, above all the influence exerted by rates of development of the brown coals of the Kansk-Achinsk basin. Fairly moderate growth of the amount of coal mined from one 5-year period to the next is determined by inadequate development of the technology for mining and transporting coal so as to fully take into account the peculiarity of this basin and the impossibility of delivering and assembling on short notice the custom-made sets of equipment for stripping, for mining and for transport. This slowed down the growth rates of the production of electric power in the region, reoriented a number of the most important complexes toward production of products not requiring a sizable amount of thermal energy and electric power (an increased share of ore concentrates in the total volume of output of nonferrous metallurgy, mechanical and chemical-mechanical processing of timber, development of miniplants in ferrous metallurgy, slower transition to energy-saturated processes in chemical complexes). Speeding up development of the coal of the Kansk-Achinsk basin will have a substantial impact on the resulting indicators of the economy of the Angara--Yenisey region. In the variant that provides for creation of two additional open-cut mines for mining the brown coal of the Kansk-Achinsk basin, the volume of products shipped from the region in the 11th and 12th 5-year periods increases approximately 20 percent over the variants not containing these additional mines.

Calculation of that variant was originally undertaken in order to assess the feasibility of work to speed up economic exploitation of the coal of the Kansk-Achinsk basin. But it became clear in the course of the analysis that given the existence of substantial restrictions (especially with respect to the time of activation of large-capacity open-cut mines) the region, which possesses rich resources of primary sources of energy and which is developing not only thermal electric power production, but also hydropower potential, will nevertheless be compelled in the period of development of its own fuel and energy resources to use primary sources of energy from other regions to achieve the goals that were set. To be specific, it is possible that work will have to be done on the question of deliveries of natural and casinghead gas from West Siberia (or exploration of corresponding sources within the region) in the 11th Five-Year Plan. The principal factor determining a conclusion so paradoxical for this region is that the technology has been worked out for large-scale gas production and that the period for developing gas deposits and for construction of main gas pipelines are comparatively short.

The role of decisions taken previously in the field of capital investment turned out to be important in working out the prospects for the economic development of the Angara--Yenisey region. Partial construction and the growth of the volume of projects for modernization and reconstruction in existing industries determined to a considerable degree the load on the region's construction capability in the 10th and 11th five-year plans, especially for the Central Krasnoyarsk, Irkutsk-Cheremkhovo and Sayan TPK's. When they become available in the 1986-1990 period, these capacities can be used to do spadework for the subsequent stage of development of the region's economy. Conceptions therefore need to be worked out concerning the most important features of the region's economic development beyond 1990 and to extend the time frame at least another one or two 5-year periods.

From the spatial standpoint of the region's future development the particular role of the TPK's of the Angara Valley attracts our attention. According to the results of the calculations, this is a zone of intensive development with the formation in the Lower Angara TPK of enterprises for the production of nonferrous metals (using their own and shipped-in raw materials), with development in it of the electric power industry and petrochemistry, and with the orientation of the branches of its forest products complex toward thorough processing of the raw timber. The Bratsk--Ust'-Ilimsk TPK will become the base of support for development of the Lower Angara and Upper Lena TPK's, and later for developing the areas of the Near North as well. The branches of the forest products complex and certain production operations in ferrous metallurgy will undergo further development there.

Development of the fuel and energy complex and its unification with the production of power-intensive products of nonferrous metallurgy represent the basis for formation of the future structure of the economy of the Central Krasnoyarsk TPK. Existing sectors and industries will undergo further development along with this TPK, and the timbering industry will begin to develop and the processing of the raw timber will gradually become more thorough (mechanical and chemical-mechanical processing), and the capacities of the construction capability will increase substantially.

Development of the coal industry, of power-intensive production operations in ferrous metallurgy and of fertilizer production is combined in the future production structure of the Sayan TPK with completion of construction of projects of the machinebuilding complex and a number of other complexes whose construction began in the 9th and 10th five-year plans.

Energy-intensive production operations in petrochemistry and ferrous metallurgy and fertilizer production are supplemented in the future structure of the Irkutsk--Cheremkhovo TPK by industries traditional for this complex, which will also undergo further development (machinebuilding above all).

On the whole the calculations made it possible to define a balanced system of basic parameters of economic development of the Angara--Yenisey region linked to regional and national economic (volume of capital investments to be allocated to the region by 5-year periods) resources and the goals set for the region. At the same time it turned out that certain questions arise that are difficult to foresee in advance: development of a number of new alternatives for development of multisector and regional complexes (in particular for construction capabilities), extension of the time frame of the program, adjustment of the goals of the region's economic development (when they cannot be achieved within the planning period). For that reason the practical process of working out the prospects of a region's development goes through a number of iterations, in which unambiguous solution of the problems that arise in the course of the calculations is achieved by successive calculations for models at the national economic, sectoral and regional levels.

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